Seaver and Walton

Mental Arithmetic

Jane A. Phillips

MENTAL ARITHMETIC

DESIGNED FOR USE IN

COMMON SCHOOLS AND ACADEMIES

BY

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PREFACE.

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THE main purpose of this book is to provide an ample store of such questions as are best suited to drill in elementary arithmetical operations and to oral practice in analysis and reasoning.

That such training is most effectively given by means of questions easy enough to be worked mentally is an accepted opinion among experienced teachers. Accordingly, mental arithmetic fills a large place in courses of arithmetical study, and a separate book is often found to be a convenience, if not a necessity. It is not, however, as a substitute for written arithmetic, nor yet as a distinct subject set apart from the other, that mental arithmetic will best serve its purpose ; for the two subjects are really one, differing chiefly in method of expression, and yielding their best fruits when both are applied to the same topics at the same time. Hence mental arithmetic is an appropriate and useful study at all stages of the pupil's progress ; and a book on the subject is not properly one member in a graded series of text-books, but is rather to be regarded as a companion to them, affording a parallel enlargement of the whole course.

Such is the view that has governed in the preparation of this book. A formal and systematic development of the science of arithmetic through definitions, principles, and rules is not here undertaken. That will be found in other books, the use of which will accompany this. Neither is this a beginner's book. Such knowledge as a child gains in a primary school is here assumed at the outset. The first few sections will be found serviceable in reviewing and solidifying that knowledge. But starting with such primary knowledge, the pupil will here find a carefully selected and graded course of mental exercises which may usefully accompany his other arithmetical study to the end. He will find every important topic in arithmetic illustrated by a series of simple questions, which will lead him gradually by way of analysis and induction to a practical knowledge of the underlying principles. This practical knowledge of principles he will be led to apply until processes of reasoning become familiar through habitual use. Thus he will be prepared in the best way to understand the more artificial processes of written arithmetic.

It is deemed essential to right training in reasoning that the pupil should be allowed to reason in his own way, and then to give an account of his process in his own language. With the acts of reasoning, if actually performed, the teacher will have very little trouble ; but the forms of expression used by children will often be both crude and inexact. But the remedy is not to reject the pupil's expression, and drill him in some set form found ready-made in the book or devised by the teacher ; it is rather to accept his expression, however crude, as a basis to work upon, and then guide his thinking so that he may modify his expression until it assumes a good form, the teacher bearing in mind always that a form of expression however excellent possesses no value whatever if it is not a genuine expression of the pupil's own thought.   ·

The forms of solution, rather sparingly scattered through this book, are not to be regarded as models for drill, but rather as suggestions to aid the pupil in reasoning.   And the same remark applies to the forms of solution given in the Appendix.

The questions filling the body of the book fall into two general classes. First are questions which require one simple arithmetical operation, the nature of which is perceived the moment the question is read, and which is then instantly performed.   Such questions do not require previous study, and are intended for a form of class exercise which may be called *arithmetic at sight.*   The Drill tables and most of the practical questions in the earlier part of the book belong to this class.

The other class of questions consists of those which require more deliberate thought, and are more especially adapted to oral practice in analysis and reasoning.   These questions are more abundant in the latter part of the book, and the last sections are filled with miscellaneous questions which are wholly of this kind.

The very favorable reception accorded to their other books, leads the authors to hope that this work may be found acceptable and useful.

NEWTON, August, 1884.

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Numbers from One to Ten.

									▢	*1.*	One.
								▢	▢	*2.*	Two.
							▢	▢	▢	*3.*	Three.
						▢	▢	▢	▢	*4.*	Four.
					▢	▢	▢	▢	▢	*5.*	Five.
				▢	▢	▢	▢	▢	▢	*6.*	Six.
			▢	▢	▢	▢	▢	▢	▢	*7.*	Seven.
		▢	▢	▢	▢	▢	▢	▢	▢	*8.*	Eight.
	▢	▢	▢	▢	▢	▢	▢	▢	▢	*9.*	Nine.
▢	▢	▢	▢	▢	▢	▢	▢	▢	▢	*10.*	Ten.

Numbers from Ten to Twenty.

Ten.	Eleven.	Twelve.	Thirteen.	Fourteen.	Fifteen.	Sixteen.	Seventeen.	Eighteen.	Nineteen.	Twenty.
10.	*11.*	*12.*	*13.*	*14.*	*15.*	*16.*	*17.*	*18.*	*19.*	*20.*

THE SIGNS, =, +, −, ×, ÷.

The Sign of Equality, =.

This sign means *equals,* or *equal.*
Thus,   5 and 3 = 8 ;
shows that 5 and 3 together equal 8.
5 and 3 = 8 is read, " 5 and 3 *are* 8."

The Sign Plus, +.

This sign means *and.*
Thus,   5 + 3 = 8 ;
shows that 5 and 3 are 8, or that 5 with 3 *added,* is 8.
5 + 3 = 8 is read, " 5 *and* 3 are 8."

The Sign Minus, −.

This sign means *less.*
Thus,   10 − 3 = 7 ;
shows that 3 taken, or *subtracted,* from 10 leaves 7.
10 − 3 = 7 is read, " 10 *less* 3 is 7."

The Sign of Multiplication, ×.

This sign means *multiplied by.*
Thus,   4 × 3 = 12 ;
shows that 4 taken 3 times makes 12.
4 × 3 = 12 is read, " 4 *multiplied by* 3 is 12."

The Sign of Division, ÷.

This sign means *divided by.*
Thus,   20 ÷ 4 = 5 ;
shows that 20 contains five 4's, or that one fourth of 20 is 5.
20 ÷ 4 = 5 is read, " 20 *divided by* 4 is 5."

MENTAL ARITHMETIC.

SECTION I.

ADDITION AND SUBTRACTION.

Numbers from one to ten.

1. 1. One book is on Henry's desk, and two books are on Mary's. How many are on both desks?

2. In my right hand are two pens, in my left are three. How many are there in both hands?

3. Frank gave a five-cent piece to pay for four cents' worth of figs. What change should he receive back?

4. There are three girls on one end of a tilt, and three on the other. How many on both?

5. In a cage are three rabbits, two mice, and one squirrel. How many animals in all?

6. Ruth had six peaches, and ate two of them. How many were left?

7. Horace caught eight fishes, but threw away four of them. How many had he then?

8. After selling four calves, a farmer has three left. How many had he at first?

9. In a window of eight panes, two are broken. How many are whole?

10. How many days are there in a week? How many remain after Sunday, Monday, and Tuesday have passed?

11. I have a horse which was five years old three years ago; how old is he now?

12. Four girls and five boys are skating. How many children are there in all?

13. Nine persons were invited to a party; all but two came. How many came?

14. There are six horses in the stable, three in the yard, and one in the pasture. How many are there in all?

15. From a pail containing ten quarts, three quarts leaked out. How many quarts remained?

16. A number of boys were on the beach; after five had gone away, five still remained. How many were there at first?

17. In a nest are six eggs. If three more be laid in the nest, how many will there be then?

18. Willie has five cents; with three more he can buy a ball. What is the cost of the ball?

19. From Boston to Malden is four miles; to Wakefield is six more. How far is it from Boston to Wakefield, going through Malden?

20. Ella has five books; Jane has four more than Ella. How many has Jane?

21. A man has nine oranges, his boy has six. How many less has the boy than the man?

22. Frank goes to bed at eight o'clock, Robert at six. How much earlier does Robert go than Frank?

23. Robert's knife has three blades, Frank's has five. How many more blades has Frank's knife than Robert's?

24. Frank's age is ten years, Robert's is seven. What is the difference between their ages?

25. Fanny arose at four o'clock; how many hours had she been up at ten o'clock?

26. Two boys were standing together; one walked east four feet, and the other walked west five feet. How far apart were they then?

27. In a room are 2 armchairs, 2 rocking chairs, and 6 common chairs. How many chairs are there in all ?

28. A plough which cost seven dollars, sold for four dollars. less than it cost. For how much did it sell ?

29. Count by twos from two to ten and back; from one to nine and back.

30. Count by threes from three to nine and back; from one to ten and back; from two to eight and back.

2. The pupils may make questions about putting three apples with another number of apples; about taking part of eight cents away; about two boys walking away from each other.

3. Give at sight answers to the following:

	i.	ii.	iii.	iv.	v.
a.	1 + 1	5 − 1	5 + 3	6 + 2	7 − 5
b.	3 + 3	6 + 1	10 − 5	4 + 6	7 − 4
c.	2 + 2	3 − 1	3 + 7	9 − 2	10 − 7
d.	3 + 1	5 + 2	9 − 6	1 + 7	9 − 3
e.	2 − 1	1 + 5	4 + 5	9 − 1	10 − 2
f.	1 + 2	6 − 4	8 − 3	10 − 1	5 − 4
g.	2 + 3	7 − 1	2 + 8	8 − 4	8 − 2
h.	3 − 2	7 − 3	2 + 6	7 − 2	8 + 2
j.	6 − 1	4 + 2	8 − 6	10 − 9	5 − 3
k.	1 + 4	4 − 3	5 + 4	9 − 4	10 − 3
l.	4 − 2	3 + 4	10 − 6	6 + 4	4 + 3
m.	4 + 1	6 − 5	7 + 1	9 − 8	7 + 2
n.	3 + 2	4 − 1	3 + 5	5 + 5	9 + 1
o.	2 + 1	5 + 1	10 − 8	1 + 9	9 − 7
p.	5 − 2	1 + 6	3 + 6	7 + 3	9 − 5
q.	2 + 4	7 − 6	8 − 7	10 − 4	8 + 1
r.	6 − 2	4 + 4	2 + 5	2 + 7	6 + 3
s.	1 + 3	6 − 3	8 − 5	8 − 1	1 + 8

SECTION II.

MULTIPLICATION AND DIVISION.

Numbers from one to ten.

4. 1. There are two pages on one leaf of a book. How many pages are there on three leaves ?   [See page 168.]

2. How many blades are there in two pairs of scissors ?

3. What is the cost of four peaches at two cents apiece ?

4. What is the cost of two pears at four cents apiece ?

5. John has six plums, which are just enough to give his sisters three apiece.   How many sisters has he ?   [See page 168.]

6. How many apples at two cents each can be bought for four cents ? for six cents ?

7. How many oxen are there in three yoke of oxen ?

8. Mr. Day has eight oxen.   How many yoke of oxen has he ?

9. How many horses in one span ?   in four span ?

10. Mr. Otis has five horses.   How many span of horses can he harness and how many horses has he besides ?

11. John walked three miles in an hour, but James rode three times as far.   How far did James ride ?

12. How many pounds of butter are there in two boxes of five pounds each ?

13. Job can carry into the house four sticks of wood at a time.   How many times must he go to carry in eight sticks ?

14. How many desks will be required to seat ten pupils, if two pupils can sit at each desk ?

15. How many settees will be required to seat ten pupils, if five pupils can sit upon each settee ?

16. If one cent will buy three needles, how many needles will two cents buy ?

17. If one apple is worth four dates, how many dates are two apples worth ?

18. Three feet equal one yard. How many feet equal two yards ? three yards ?

19. How many feet are there in two yards and two feet ?

20. Four quarts make a gallon. How many quarts in one gallon and two quarts ? in two gallons and one quart ?

21. A man owing nine dollars, gave in payment of his debt two calves at four dollars each and the rest in money. How much money did he pay ?

22. How many gallons in four quarts ? in six quarts?

23. How many gallons in eight quarts ? in nine quarts ? *Ans.* Two gallons and one quart over.

24. How many yards are there in six feet ? in seven feet ?

25. How many yards in nine feet ? in ten feet ? in five feet ?

26. A half dime is five cents. How many half dimes in eight cents ? in ten cents ?

5. Give at sight answers to the following :

27. Two 2's ? two 1's ? two 4's ? 2×2? 2×5? 1×2?

28. Three 2's? two 3's? two 5's? 4×2? 1×3? 5×2?

29. Five 2's? three 3's? six 1's ? 2×4? 3×1? 3×3?

30. Four 2's? one 3 ? one 4 ? 2×3? 3×2? 1×3?

31. How many 2's in 4 ? in 6 ? in 2 ? in 8 ? in 10 ?

32. How many 2's in 5 ? in 7 ? in 3 ? in 9 ? *First ans.* Two and one over.

33. How many 3's in 6 ? in 9 ? in 3 ? in 10 ? in 8 ?

34. How many 5's in 10 ? in 5 ? in 7 ? in 9 ?

35. How many 4's in 8 ? in 6 ? in 9 ? in 7 ? in 10 ?

6. The pupils may make questions

Using four 2's ; about dividing 6 things among their friends ; about spending 10 cents for any kind of fruit.

SECTION III.

MISCELLANEOUS.

7. 1. Eight boys were flying a kite; all but two of them went away. How many went away?

2. Alfred has five prunes and May has three more than Alfred. How many has May?

3. How many boots are there in five pairs of boots?

4. Martin had eight apples in his basket; he picked two more and lost one. How many had he then?

5. Four men and five women sat down to dinner; two of the women soon left. How many persons remained?

6. On a Christmas tree eight candles were lighted, but four of them went out. How many remained lighted?

7. A scissors grinder ground two pairs of scissors and a three-bladed knife. How many blades did he grind?

8. At two cents apiece, how many marbles will ten cents buy?

9. If you should walk three rods north, and then turn and walk eight rods south, how far would you be from the place where you first started?

10. If three boys can weed a garden in three hours, how many hours will it take one boy to weed it?

11. If one barrel of flour will last a family three months, how long will two barrels last the same family? How long will three barrels last them?

12. If a quantity of coffee will serve five persons two days, how long will it serve one person?

13. To do a piece of work it takes two boys three hours. How many hours will it take one boy to do it?

14. At the rate of three bushels for one dollar, how many bushels of turnips will three dollars buy?

15. If a man earns two dollars a day and his team earns two dollars a day, how many dollars do both earn in one day? in two days?

16. To pay for a barrel of flour worth eight dollars, a man gave as many sheep as he could at three dollars each and the rest in money. How many sheep did he give, and how much money?

17. Joseph had ten guinea-pigs and gave four apiece to his two friends, keeping the rest. How many did he keep?

18. John and Charles start together to run around a lot. John runs around it ten times and Charles seven. How many more times does John run around than Charles?

19. A boy sold one paper for three cents, and three papers for two cents each. How much did he get?

20. James found two hen's nests with two eggs in each, which he put into a third nest that already had five eggs in it. How many eggs were there in the third nest then?

21. When oranges are sold for five dollars a box, how many boxes can you buy with four 2-dollar bills and two 1's?

22. A railroad car, having run three miles in one direction, ran three times as far in the opposite direction. How far was it then from its starting place?

23. After selling one clock apiece to five persons, and two clocks apiece to two persons, a peddler had one clock left. How many had he at first?

24. Mrs. Blake earned three dollars in a week, and her husband earned twice as much, lacking one dollar. How much did both earn?

25. One day I found two friends at my house; and seeing there were but four apples on the plate, I went to the cellar and brought up as many more as would give my friends and myself three apiece. How many did I bring up?

26. Milo went to the store with eight cents and bought two yards of braid at three cents a yard, and spent the rest of the money for picture cards at the rate of five for a cent. How many cards did he buy?

SECTION IV.

ADDITION AND SUBTRACTION.

Numbers from one to twenty.

8. 1. If you have 9 cents in your purse and put 2 more cents with them, how many cents will then be in the purse ?

2. Margaret is 9 years old. How old will she be in 7 years ?

3. A man bought a dog for 13 dollars, and sold it for 5 dollars less than he paid. For how much did he sell it ?

4. Nora has put 7 plates on the table. How many more plates must she put on to give a plate to each of a family of 11 persons ?

5. A pencil and some rubber cost 13 cents ; the rubber cost 9 cents. How much did the pencil cost ?

6. Horace walked 7 miles after breakfast and 7 after dinner. How many miles did he walk in all ?

7. Ellen bought 8 plums for a cent. If she had spent another cent, how many plums in all could she have bought ?

8. Ellen has 14 grapes in two clusters. In one cluster there are 8 grapes. How many grapes are in the other cluster ?

9. A pair of boots cost 11 dollars, and a pair of shoes cost 3 dollars. What is the difference in their cost ?

10. A shawl cost 14 dollars, and a bonnet 5 dollars less than the shawl. How many dollars did the bonnet cost ?

11. A man bought a chair for 8 dollars, and sold it for 15 dollars. How much did he gain ?

12. A post and a chain cost 17 dollars. The chain cost 8 dollars. How much did the post cost ?

13. If out of a dozen eggs 6 are taken for an omelet, how many eggs are left ?

14. Dora is 15 years old and is 6 years older than her brother. How old is her brother ?

15. A physician made 4 visits on Monday, 4 on Tuesday, and 9 the next day. How many did he make in all?

16. Count by 2's from 2 to 20 and back; from 1 to 19 and back.

17. Count by 3's from 3 to 18 and back; from 1 to 19 and back; from 2 to 20 and back.

18. Count by 4's from 4 to 20 and back; from 1 to 17 and back; from 2 to 18 and back; from 3 to 19 and back.

19. Count by 5's from 5 to 20 and back; from 1 to 16 and back; from 2 to 17 and back, and so on.

9. Give at sight answers to the following:

	i.	ii.	iii.	iv.	v.
a.	8 + 4	11 − 4	6 + 5	18 − 9	17 − 10
b.	8 + 7	8 + 8	7 + 9	7 + 5	8 + 10
c.	20 − 10	16 − 9	17 − 9	14 − 9	16 − 8
d.	10 + 2	10 + 8	9 + 8	6 + 9	6 + 8
e.	16 − 6	12 − 9	12 − 5	12 − 8	3 + 10
f.	15 − 7	10 + 1	7 + 8	9 + 2	13 − 8
g.	8 + 9	11 − 5	16 − 7	11 − 8	15 − 6
h.	18 − 8	4 + 9	15 − 8	10 + 9	11 − 9
j.	8 + 6	4 + 10	5 + 7	7 + 10	9 + 10
k.	13 − 4	19 − 9	13 − 6	16 − 10	17 − 8
l.	3 + 8	9 + 9	4 + 7	3 + 9	7 + 7
m.	15 − 10	11 − 3	11 − 6	14 − 10	11 − 7
n.	9 + 4	10 + 10	8 + 5	7 + 6	10 + 7
o.	12 − 10	12 − 4	18 − 10	19 − 10	13 − 10
p.	5 + 10	6 + 6	6 + 10	2 + 9	9 + 3
q.	13 − 7	5 + 8	12 − 3	11 − 10	14 − 7
r.	6 + 7	14 − 5	10 + 4	7 + 4	9 + 5
s.	15 − 9	4 + 8	14 − 6	5 + 6	13 − 9
t.	8 + 3	11 − 2	10 + 3	12 − 7	10 + 6
u.	17 − 7	9 + 6	12 − 6	2 + 10	14 − 8
v.	1 + 10	15 − 5	5 + 9	13 − 5	8 + 9

SECTION V.

MULTIPLICATION AND DIVISION.

Numbers from one to twenty.

10. Repeat the following table:

LIQUID MEASURE.

4 gills   =   1 pint
2 pints   =   1 quart
4 quarts =   1 gallon.

1. How many gills are there in 1 quart? in 2 quarts?

2. How many pints are there in 6 quarts? in 1 gallon? in 2 gallons and 1 quart?

3. How many quarts are there in 3 gallons and 1 quart?

4. If you have 16 pints of milk, how many quarts have you? how many gallons?

5. At 3 cents a pint for milk, what will 2 quarts and 1 pint of milk cost?

6. How many cups, each holding 1 gill, can be filled from a coffee pot holding 3 pints?

7. At 6 cents a quart for oil, how many quarts can I buy for 18 cents? How many quarts can I buy for 15 cents and how many cents will be left?

8. How many quarts does a 5-gallon milk can hold?

Repeat the following table:

DRY MEASURE.

2 pints   =   1 quart
8 quarts =   1 peck
4 pecks   =   1 bushel.

9. Fred has picked a pint of blackberries. How many pints must he pick in all to have a peck ?

10. If a peck of potatoes will last a family 1 week, how many weeks will a bushel last them ? How long will 5 bushels last ?

11. How many days are there in 2 weeks ?

12. If you go to school 5 days in a week, how many days do you go in a month, or 4 weeks ?

13. After taking as many 5's out of 18 as possible, how many 1's will be left ?

14. Luther bought a pint of peanuts every week-day for a fortnight. How many quarts did he buy ? How many more pints should he buy to make a peck in all ?

15. My parlor is 12 feet wide. How many breadths of carpeting each a yard wide, will it take to cover it ?

16. At 1 dollar a yard, what will be the cost of a piece of carpeting 18 feet long ?

17. If a room is 15 feet long and 12 feet wide, what are its dimensions in yards ?

Give at sight answers to the following :

18. Six 2's ? two 6's ? nine 2's ? 6×2 ? 8×2 ? 4×3 ?

19. Five 3's ? seven 2's ? six 3's ? 2×9 ? 2×6 ? 9×2 ?

20. Four 4's ? four 3's ? five 4's ? 5×3 ? 7×2 ? 4×5 ?

21. Three 6's ? two 9's ? two 7's ? 2×10 ? 6×3 ? 5×4 ?

22. Eight 2's ? three 5's ? ten 2's ? 4×4 ? 3×5 ? 10×2 ?

23. Two 10's ? two 8's ? four 5's ? 3×6 ? 2×8 ? 2×7 ?

In each of the following numbers,

11, 14, 13, 12, 15, 18, <u>17</u>, 20, 16, 19,

24. How many 2's ?
25. How many 3's ?
26. How many 4's ?
27. How many 5's ?

28. How many 6's ?
29. How many 7's ?
30. How many 8's ?
31. How many 9's ?

SECTION VI.

MISCELLANEOUS.

12. 1. Richard picked up 13 apples under one tree, 1 under another, 3 under another, and 2 under another. How many apples did he pick up ?

2. A newsboy sold 14 papers on the street, 2 in an office, and 4 in a horse car. How many papers did he sell ?

3. Edgar ate 12 plums, and then had 7 left. How many plums had he at first ?

4. Dora had 18 filberts. She ate 4, threw away 2, and gave the rest to Mary. How many did she give to Mary ?

5. Granville had 16 cents. He paid 7 cents for a book and 7 for some paper. How many cents had he left ?

6. There are 17 goblets and 12 cups on the shelf. How many more goblets than cups are there ?

7. Ellen has 13 pinks, 2 roses, and twice as many pansies as roses. How many flowers has she ?

8. There are 4 books on one shelf and 3 times as many on another shelf. How many books are on both shelves ?

9. Four lamps sold for the following prices : 6 dollars, 5 dollars, 4 dollars, and 3 dollars. How many dollars were received for all ?

10. A fisherman found 8 lobsters in one cage, and 6 in another. After throwing away 5, how many had he left ?

11. A man who had 17 dollars, spent 3 for a hat, and 5 for a vest. How many dollars had he left ?

12. Jane is 12 years old, Oscar is 2 years older than Jane, and Samuel is 3 years older than Oscar. How old is Samuel ?

13. A dime is 10 cents. How many cents have I in 1 dime, a 5-cent piece, and 3 cents ?

⨯ 14. I have a 5-cent piece, 2 cents and a dime. How many more cents must I get to have 20 cents ?

15. Mary and Sarah together gave 18 cents for a book. Mary gave two 5-cent pieces and 1 cent, and Sarah gave the rest. How many cents did Sarah give ?

16. Sixteen ounces make a pound. How many two-ounce packages will weigh a pound ?

17. Nineteen days are how many weeks and days ?

18. Nineteen inches are how many more than 12 inches ?

19. Nineteen ounces are how many pounds and ounces ?

20. A cat has 5 toes on each of her fore feet, and 4 toes on each hind foot. How many toes has she in all ?

21. A dog has 5 toes on each foot. How many more toes has a dog than a cat ?

22. A boy sold 4 apples for 9 cents, and 8 apples for 8 cents. How many apples did he sell ? How many cents did he receive ?

23. Charles had 8 cents ; he earned 4 cents more yesterday, and twice as many cents to-day. If he has 8 cents besides those he earned, how many cents has he in all ?

✗ 24. Two birds fly from the same place in the same direction, one 18 miles and the other 11 miles. How far apart are they ?

25. Two boys started at the same place and walked in opposite directions, one at the rate of 4 miles an hour, and the other at the rate of 3 miles an hour. How far apart were they at the end of 2 hours ?

26. What is the cost of a yard of muslin at 12 cents a yard, and 2 rolls of tape at 4 cents a roll ?

27. There are 7 red stripes and 6 white stripes on a United States flag. If two of the white stripes and 3 of the red stripes be torn away, how many stripes remain ?

28. Eli caught 3 fishes in the brook, twice as many in the river, and enough more in the pond to make 15 in all. How many did he catch in the pond ?

SECTION VII.

FINDING PARTS OF NUMBERS.

Numbers from one to ten.

13. 1. A man gives 2 boys 4 pears to share equally. How many pears does each boy have ? [See page 168.]

When a number is divided into two equal parts, one of the parts is called *one half* of the number.

2. What is one half of 4 pears ?

3. What is one half of 6 pears ?

4. What is one half of 8 pears ?

5. What is one half of 10 pears ?

6. What is one half of 6 apples ? of 4 pencils ? of 8 books ? of 10 marbles ?

7. If 1 apple be divided equally between 2 boys, what part of the apple does 1 boy have ? *Ans. One half* of the apple.

8. When anything is divided into two equal parts, what is one of the parts called ?

9. What is one half of 3 ? *Ans.* One half of three is one and one half.

10. If you divide 3 yards of ribbon equally between Ruth and Grace, how much will each have ?

11. What is one half of 5 ?

12. What is one half of 7 ?

13. What is one half of 9 ?

14. If 3 boys share 6 apples equally, what part of the apples does 1 boy have ? *Ans. One third* of the apples.

15. What is one third of 6 apples ?

16. What are two thirds of 6 apples ? [See page 160.]

17. What is one third of 9 apples ?

18. What are two thirds of 9 apples ?

19. What is one third of 6 dates ? of 3 figs ? of 9 days ?

20. What are two thirds of 6 dates ? of 3 figs ? of 9 days ?

21. If 3 boys share one apple equally, what part of the apple does each boy have ? *Ans.* **One third** of the apple.

22. When anything is divided into three equal parts, what is one of the parts called ?

23. What is one third of 4 ? *Ans.* One third of four is one and one third.
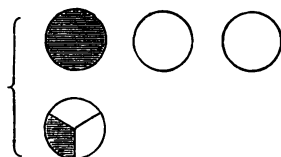
24. What is one third of a yard of velvet worth at 1 dollar a yard ? at 4 dollars a yard ?

25. What is one third of 6 ? of 7 ?

26. If 7 gallons of milk fill 3 cans, how much will fill 1 can ?

27. What is one third of 9 ? of 10 ?

28. A father said to his three little boys, " I will divide these two oranges equally among you if you will tell me how to do it." The eldest boy said, "Cut one orange into three equal parts, and give us each a part, then cut the other into three equal parts and give us each a part." What part of an orange would each boy then have ? *Ans.* **Two thirds** of an orange.

29. What is one third of 2 ? *Ans.* One third of two is two thirds.

30. If 1 dollar will buy 2 melons, what part of a melon will one third of a dollar buy ?

31. What is one third of 5 ? *Ans.* One third of five is one and two thirds.

32. If a barrel of cranberries is worth 5 dollars, what is one third of a barrel worth ?

33. What is one third of 6 ? of 8 ?
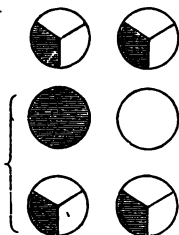
34. A man earned 8 dollars in 3 days. How much did he earn in 1 day ?

35. Four girls divide 4 yards of ribbon equally among them. What part of the ribbon does each girl have ? *Ans. **One fourth** of the ribbon.*

36. What is one fourth of 4 yards ?

37. What are two fourths of 4 yards ? What are 3 fourths of 4 yards ?

38. What is one fourth of 8 yards ? 2 fourths of 8 yards ? 3 fourths of 8 yards ?

39. If 4 girls share a garden equally, what part of the garden does each girl have ? *Ans. **One fourth** of the garden.*

40. When anything is divided into 4 equal parts, what is 1 of the parts called ?

41. What is one fourth of 5 ? *Ans.* One fourth of 5 is 1 and 1 fourth.

42. A wheel turns 4 times in going 5 rods; in turning once how many rods will it go ?

43. What is one fourth of 8 ? of 9 ?

44. If 2 melons were to be shared equally by 4 men, what part of the melon would each man get ? *Ans.* Two fourths of a melon.

45. What is one fourth of 2 ? *Ans.* One fourth of 2 is 2 fourths.

46. What is one fourth of 6 ? *Ans.* One fourth of 6 is 1 and 2 fourths.

47. If there are 6 hours in a school day and Ella is at school one fourth of the time, how many hours is she at school ?

48. What is one fourth of 8 ? of 10 ?

49. If 3 oranges were to be shared equally by 4 boys, what

part of an orange would each boy get? *Ans.* Three fourths of an orange.

50. Then one fourth of 3 equals what part of 1? *Ans.* One fourth of 3 equals 3 fourths of 1.

51. What is one fourth of 7? *Ans.* One fourth of 7 is 1 and 3 fourths.

52. Annie had 7 yards of lace. She took one fourth of it to trim an apron. How many yards did she take?
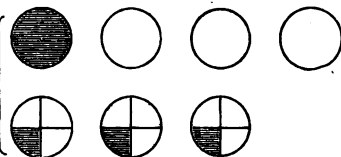
53. John had to work 9 hours for Mr. Field. When he has worked one fourth of the time, how many hours has he worked?

54. If 4 dollars will buy 6 bushels of peas, how many bushels will 1 dollar buy?

55. One pipe will empty a cistern in 3 hours; in what time will 4 pipes empty it?

56. If 5 children have 10 cents to share equally, what part of the money will each child have? *Ans.* *One fifth* of the money.

57. What is one fifth of 10 cents?

58. What are two fifths of 10 cents? 3 fifths of 10? 4 fifths of 10?

59. A melon was divided into 5 equal parts, and one part was given to John. What part of the melon did John have? *Ans.* *One fifth* of the melon.
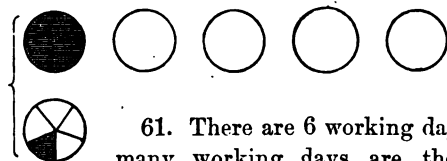
60. What is one fifth of 6? *Ans.* One fifth of 6 is 1 and 1 fifth?

61. There are 6 working days in a week. How many working days are there in 1 fifth of a week?

2

62. What is one fifth of 2?
Ans. One fifth of 2 is 2 fifths.
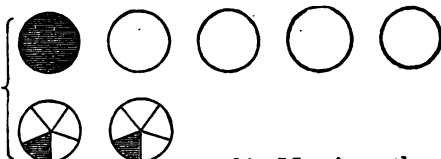
63. What is one fifth of 7? *Ans.* One fifth of 7 is 1 and 2 fifths.

64. Mary's mother had 7 quarts of milk, and used 1 fifth of it for custards. How much milk did she put in the custards?

65. What is one fifth of 5? of 8? one fifth of 9?

66. If you should cut an apple into 6 equal parts and eat one of the parts, what part of the apple would you eat? *Ans.* **One sixth** of the apple.

67. Suppose the apple cut into 7 equal parts, what would you call one of the parts?

68. Suppose it cut into 8 equal parts and I took one, what part of the apple should I take?

69. What do you think one of the 9 equal parts of an apple would be called?

70. A man gave two dollars for 5 fowls. What part of a dollar did he give for one?

71. Annie had 3 yards of ribbon, and put one fifth of it into a bow. How much ribbon did she put into the bow?

72. Eva's mother stayed from home 10 hours, and Eva sewed 1 seventh of that time. How long did Eva sew?

73. Charles had 8 miles to go. If, after walking 1 sixth of the distance, he rode the rest of the way, how far did he walk?

74. John had 6 apples; he gave 1 third of them to Fanny and 2 sixths of them to Grace. How many apples did he give to Fanny? How many did he give to Grace?

75. Is there any difference between 1 third of a number and 2 sixths of the same number?

76. If a yard of cloth is worth 8 dollars, how much is 1 fourth of a yard worth? 2 fourths of a yard? 3 fourths of a yard?

77. What is 1 half of 8 cents? 2 fourths of 8 cents?

78. Is there any difference between 1 half of a number and 2 fourths of the same number?

14. 79. If 2 dollars will buy a ream of paper, what part of a ream will 1 dollar buy? ·

80. One dollar is what part of two dollars? [See page 168.]

81. If 3 goats yield a gallon of milk in a day, what part of a gallon does 1 goat yield?

82. Three feet make a yard. What part of a yard is 1 foot? 2 feet?

83. What part of 3 is 1? What part of 3 is 2?

84. Four men can do a piece of work in an hour. What part of the work can one man do in the same time? what part can two men do?

85. What part of 4 is 1? What part of 4 is 2?

86. If 5 cents will buy a pound of nails, what part of a pound will 1 cent buy? what part will 2 cents buy? 7'

87. What part of 5 is 1? What part of 5 is 2?

88. Five miles is the distance to a certain town. What part of the distance has a person gone when he has walked 3 miles? What part has he to go?

89. What part of 5 is 3? What part of 5 is 2?

90. A stake which is 6 feet long has 3 feet in the ground. What part of the stake is in the ground?

91. Three is what part of 6?

92. In a lot of 6 fishes, 2 are trout and the rest bass. What part of the fishes are trout? What part are bass?

93. What part of 6 is 2? What part of 6 is 4?

94. A man starts to travel 8 miles. When he has travelled 2 miles, what part of the distance has he to travel?

95. What part of 8 is 6?

SECTION VIII.

FINDING NUMBERS WHEN PARTS OR MULTIPLES ARE GIVEN.

Numbers from one to ten.

15. 1. How much money have you if 2 cents is half of all the money you have ? Two is 1 half of what number ? [See page 168.]

2. Philo did 1 half of his work in 4 hours. How long would it take him to do the whole work ? 4 is 1 half of what number ?

3. The age of William is 3 years. If this is 1 half of the age of Ross, what is the age of Ross ? 3 is 1 half of what number ?

4. How much money have you if 2 cents is 1 third of all the money you have ? 2 is 1 third of what number ?

5. If 1 third of a ton of coal costs 3 dollars, what is the cost of 1 ton ? 3 is 1 third of what number ? //

6. John had 4 doves, which is two times as many as Oscar had. How many had Oscar ? 4 is 2 times what number ? [See page 169.]

7. Harry missed 6 words in his spelling lesson, which was twice the number Ellen missed. How many words did Ellen miss ? 6 is 2 times what number ?

8. Eight is 2 times what number ? 10 is 2 times what ?

9. Abbie has worked on her knitting 9 hours, which is 3 times as long as Sarah has worked. How many hours has Sarah worked ? 9 is 3 times what number ?

10. Six is 3 times what number ? 3 is 3 times what ?

11. John sold a kite for 10 cents, which is 5 times the cost of the materials. What was the cost of the materials ?

12. A potato patch yielded 8 bushels of potatoes. If this is 4 times the quantity planted, how many bushels were planted ?

13. Eight is 4 times what number ? 8 times what ?

14. If 2 thirds of a yard of ribbon costs 4 cents, how many cents does 1 third of a yard cost ? If 1 third of a yard costs 2 cents, how much will 3 thirds, or a yard, cost ?

15. If 2 thirds of a yard of plush costs 6 dollars, what will 1 third of a yard cost ? What will a yard cost ?

16. If 6 is 2 thirds of some number, what is 1 third of the number ? What is the whole number ? [See page 169.]

17. Having ridden 4 miles, Mr. Ford finds he has gone 2 fifths of his journey. How many miles in 1 fifth of his journey ? How many miles in 5 fifths, or the whole journey ?

18. If 4 is 2 fifths of some number, what is 1 fifth of the number ? What is the whole number ?

19. Warren has 3 pictures, which is 3 fourths the number Eva has ; what is 1 fourth of the number Eva has ? What is 4 fourths, or the whole number she has ?

20. If 3 is 3 fourths of some number, what is 1 fourth of the number ? What is the whole number ?

21. When 6 cents is paid for 3 fourths of a quart of milk, what is the cost of 1 fourth of a quart ? What is the cost of one quart ?

22. If 6 is 3 fourths of some number, what is 1 fourth of the number ? What is the whole number ?

23. Alice's school keeps 8 months in the year. If this is 4 fifths of the time Walter's school keeps, what is 1 fifth of the time Walter's keeps ? What is the whole time ?

24. If 8 is 4 fifths of some number, what is 1 fifth of the number ? What is the whole number ?

25. Six dollars equals 3 fifths of a gold eagle ; how many dollars equal 1 fifth of an eagle ? How many dollars equal a whole eagle ? 6 is 3 fifths of what number ?

SECTION IX.

MISCELLANEOUS.

16. 1. If you have 9 pears and give 1 third of them to Fanny, how many will you give to Fanny ?   How many will you have left ?

2. Ada had 10 nuts and gave 2 fifths of them to Sarah. How many did she give to Sarah ?

3. Harry has 9 rose-bushes.   How many rows can he set out if he puts 2 in each row, and how many rose-bushes will he have left ?

4. If Harry has 9 rose-bushes and puts 4 in each row, how many rows will he have, and what will he have left ?   How many rows will he have if he puts 3 in each row ?

5. I have 3 rows of tomato plants, 3 in each row, and 1 plant besides.   How many plants have I in all ?

6. Divide 7 pens between yourself and Fanny so that she will have 1 pen more than you.   How many will each have ?

7. Divide 10 apples as far as you can equally among 3 boys and give the remainder to Mary.   How many will you give to Mary ?

8. How many more letters are there in 2 words of 5 letters each, than in 1 word of 6 letters ?

9. George spent 2 cents, which was 1 third of all he had. How many cents had he ?

10. Mary found 2 cents, which was 1 fourth as many as she had at first.   How many cents had she at first ?   How many in all ?

11. Which is greater, and how much, 1 half of 6 apples or 1 third of 6 apples ?

12. Which is greater, and how much, 1 fourth of 8 apples or 1 third of 9 apples ?

13. What number is 1 greater.than 2 times 3 ?

14. What number is 1 less than 2 times 3 ?

15. How many cream cakes at 4 cents apiece can you buy for 10 cents, and how many cents will you have left ?

16. If you have 8 oranges and give 1 half of them to Grace, 1 fourth to Samuel, 1 eighth to Harris, and keep the rest, how many will you keep ?

17. Half of 8 and 1 half of 10 are how many ?

18. Amy had 6 cents, which was 3 fourths as much as Arthur had, and both spent their money for corn-balls at 1 cent apiece. How many corn-balls did Amy buy ?   How many did Arthur buy ?

17. Give at sight answers to the following :

19. 1 third of 6 ? of 3 ? of 9 ?

20. 2 is 1 fourth of what ?

21. 4 is 2 times what ?

22. 8 is 4 times what ?

23. 2 fourths of 8 ? of 4 ?

24. 3 fifths of 5 ? of 10 ?

25. 2 is 1 half of what ?

26. 2 is 1 fifth of what ?

27. 10 is 2 times what ?

28. 2 thirds of 6 ? of 3 ? of 9 ?

29. 6 is 3 times what ?

30. 3 is half of what ?

31. 8 is 4 times what ?

32. 3 fourths of 4 ? of 8 ?

33. 6 is 2 times what ?

34. 2 fifths of 5 ? of 10 ?

35. 2 is 1 third of what ?

36. 9 is 3 times what ?

37. 10 is 5 times what ?

38. 4 fifths of 5 ? of 10 ?

39. 4 is half of what ?

40. 3 is 1 third of what ?

41. 6 is 3 fourths of what ?

42. 2 is 2 fifths of what ?

43. 4 is 2 fifths of what ?

44. 4 is 4 fifths of what ?

45. 8 is 4 fifths of what ?

46. 6 is 2 thirds of what ?

47. 2 is 2 fourths of what ?

48. 2 is 2 thirds of what ?

49. 4 is 2 thirds of what ?

50. 5 is 5 sixths of what ?

18. The pupils may make examples which require

Finding part of a number ; finding the whole when 1 third is given ; finding the whole when 2 fifths are given.

SECTION X.

MULTIPLICATION AND DIVISION; FINDING PARTS OF WHOLES AND WHOLES FROM PARTS.

Numbers from one to twenty.

19. 1. If 2 pairs of boots cost 12 dollars, how much will 1 pair cost? What will 3 pairs cost? [See page 169.]

2. Arrange 15 marbles in 3 equal rows. How many are there in 1 row? in 2 rows?

3. If a yard of plush cost 16 dollars, what will 1 fourth of a yard cost? what will 3 fourths of a yard cost?

4. Mr. Mead had 20 sheep and sold 1 fifth of them to Mr. Oaks. How many did he sell to Mr. Oaks? He sold 3 fifths to Mr. Day. How many did he sell to Mr. Day? How many did he keep?

5. A man walked 12 miles in 4 hours. How many miles did he walk in 1 hour? in 3 hours?

6. James had 18 cents and paid 1 third of his money for repairing his skates. How much did he pay out? How much had he left?

7. Arrange 20 buttons in 4 equal rows. How many are there in each row? Arrange them in ten equal rows, and tell how many buttons there are in 1 row; in 7 rows.

8. I paid 16 dollars for 4 saddles. What should I pay for 2 saddles at the same rate?

9. If 3 fans cost 9 cents, what will 6 fans cost?

10. What will be the cost of a half dozen pencils, if they can be bought at the rate of 2 for 6 cents.

11. Of carpeting 4 fourths of a yard wide it requires 3 breadths to cover a certain floor. How many breadths would it require if the carpeting were 3 fourths of a yard wide?

12. If 10 dollars will pay for 20 hats, how many hats will 9 dollars buy?

13. By driving a team 4 miles an hour, a journey can be accomplished in 3 hours. In how many hours can it be accomplished by driving 6 miles an hour?

14. If it requires 4 days for 5 men to set the type for a book, how many days would be required for 10 men to set it?

15. How many cans of 3 pints each will hold as much as 9 cans of 2 pints each? [See page 169.]

16. How many ears of green corn at 4 cents each will pay for 2 pounds of lamb at 8 cents per pound?

17. How many bundles of laths at the rate of 5 bundles for a dollar, can be paid for with the wages of a man for 2 days at 2 dollars a day?

18. What number of school days of 5 hours each, will equal in time 2 working days of 10 hours each?

19. When quails are worth 2 fifths of a dollar apiece, how many quails will pay for 2 sheep at 7 fifths of a dollar apiece?

20. Supposing 4 quarts of milk to make 1 pound of cheese, how many pounds of cheese can be made from 20 quarts of milk?

21. A brick is 2 inches thick, 4 inches wide, and 8 inches long. How many bricks laid lengthwise will extend as far as 4 laid widthwise?

22. How many bricks laid widthwise will extend as far as 10 laid edgewise?

23. Mary gave 6 dates to Emma, which was half of all she had. How many had she?

24. Four is 1 third of what number? 1 fourth of what number?

25. Three is 1 fifth of what number? 1 fourth of what?

26. Robert spent 6 cents for candy, which was 1 third of all he had. How much money had he?

27. Mr. Jones picked apples for Mr. Pratt, keeping 1 bushel out of every 6 bushels picked. What part of the apples picked did he keep? If Mr. Jones kept 3 bushels, how many bushels did he pick?

28. Three boys divided some cherries equally among themselves. Each boy had 5 cherries. How many had all ?

29. The circumference of a tree being about 3 times its diameter, what is the diameter of a tree whose circumference is 15 feet ?

30. Edgar walked 2 thirds of the distance to his school in 10 minutes. In how many minutes could he walk 1 third of the distance ? In how many minutes, the whole distance ?

31. 10 is 2 thirds of what number ?

32. It takes Eva 15 minutes to walk 3 quarters of a mile. In how many minutes can she walk a mile ?

33. 15 is 3 fourths of what number ?

34. If 5 eighths of a pound of figs cost 10 cents, what will a pound cost ?

35. 10 is 5 eighths of what number ?

36. After sowing 2 thirds of my grass seed, 6 pounds were left. What part of the seed was left ? How many pounds had I at first ?

37. Five eighths of a quantity of onions were sold to Mr. Breck, and the remainder, which was 6 bushels, to Mr. Rugg. How many eighths of the onions were sold to Mr. Rugg ? How many bushels were there in the whole quantity ?

38. 6 is 3 eighths of what number ?

39. After spending 1 fifth of his money, Harry had 16 cents left. How many cents had he at first ?

40. 16 is 4 fifths of what number ?

41. A man sold 2 fifths of his farm for 6 thousand dollars. What was the rest of the farm worth at the same rate ?

42. A boy sold his watch for 15 dollars, which was 5 fourths of what it cost. How much did it cost ?

43. 15 is 5 fourths of what number ?

44. Paid for a lunch basket, 20 cents, which was 5 eighths of all the money I had. How much money had I left ?

45. If 20 is 5 eighths of some number, what is 3 eighths *of the* same number ?

20. Give at sight answers to the following:

46. What is 1 half of 12? of 14? of 18? of 16?

47. What is 1 third of 12? of 18? of 15?

48. What is 2 thirds of 12? of 18? of 15?

49. What is 1 fourth of 12? of 20? of 16?

50. What is 3 fourths of 12? of 20? of 16?

51. What is 1 fifth of 15? of 20?

52. What is 2 fifths of 15? of 20? 4 fifths of 15? of 20?

53. What is 1 sixth of 12? of 18? 2 sixths of 12? of 18?

54. What is 4 sixths of 12? of 18? 5 sixths of 12? of 18?

55. What part of 12 is 6? is 4?

56. What part of 12 is 3? is 2?

57. What part of 14 is 7? is 2?

58. What part of 15 is 5? is 3?

59. What part of 16 is 8? is 4? is 2?

60. What part of 18 is 9? is 6? is 3?

61. 12 is 2 times what? 6 times what?

62. 12 is 3 times what? 4 times what?

63. 14 is 2 times what? 7 times what?

64. 16 is 2 times what? 8 times what? 4 times what?

65. 18 is 2 times what? 9 times what?

66. 18 is 3 times what? 6 times what?

67. 5 is 1 half of what? 1 third of what? 1 fourth of what?

68. 6 is 1 half of what? 1 third of what?

69. 12 is 2 thirds of what? 3 fourths of what? 3 fifths of what? 4 fifths of what? 6 sevenths of what?

70. 14 is 7 eighths of what? 7 ninths of what? 7 tenths of what? 7 thirds of what?

71. 16 is 4 fifths of what? 8 ninths of what? 8 tenths of what? 4 thirds of what?

72. 18 is 9 tenths of what? 12 is 6 sevenths of what?

SECTION XI.

MISCELLANEOUS.

21. 1. If I pay 6 dollars a year for books, 3 dollars for papers, and as much for pew rent as for both, how much do I pay for all ?

2. A week and 6 days are how many days ?

3. How many feet wide is a room that is 4 yards and 2 feet wide ?

4. George is 7 years old. How old will he be when he is twice as old and 1 year more ?

5. A man bought a chain for 12 dollars and sold it for 2 dollars more than half as much as he gave for it. For how much did he sell the chain ?

6. A has 12 cents and B has 4 cents. How many cents must A give B that their money may be equal ?

7. Mr. Frost worked 6 days for Mr. Brown and twice as many days for Mr. Smith. How many days did he work for both ?

8. Mr. Frost set out 7 pear trees, and 9 plum trees. If one fourth of these trees died, how many lived ?

9. I have a measure 2 feet long. How many times must I apply it, to measure off 6 yards ?

10. How long will 4 bushels and 3 pecks of potatoes last a family, if they use at the rate of a peck a week ?

11. Emma has 8 Christmas cards, which is 2 thirds of the number Sarah has. How many has Sarah ?

12. A man bought a house for 5 thousand dollars, paid 3 thousand dollars for repairs, and then sold it at a loss of 2 thousand dollars upon the entire cost. How much did he receive for it ?

13. A boy shovelled 4 bushels of corn into a bin before school, and 4 times as much after school. How many bushels in all did he shovel?

14. Henry went 4 rods east from school, while Alvin went 3 times as far west. How far apart were the boys then?

15. How many days are there from the 1st to the 17th of June?

16. From the 4th to the 20th of March are how many weeks and days?

17. How many more than 13 are 6 times 3?

18. How many less than 19 are 2 fifths of 20?

19. Julia is 18 years old, and David is half as old as Julia. What is the difference of their ages?

20. Eighteen is made up of what 2 equal numbers? What 3 equal numbers? What 6 equal numbers? What 9?

21. A farmer received 9 dollars for oats, and 3 for rye. If he paid 1 third of the money he received for sugar, how many dollars had he left?

22. How many plants are there in 3 rows of 5 plants each and 2 plants more?

23. How many barrels of apples at 3 dollars a barrel will pay for 2 tons of coal at 9 dollars a ton?

24. Having 18 cents, I spent 1 half of my money, and gave 1 third of the remainder to Charles. How much did he receive?

25. Maggie is 10 years old; Kate is 3 years older than Maggie. In how many years will Kate be 16 years old?

26. Maggie went to the store with 20 cents. She bought 2 toys at 4 cents each, some crackers for 10 cents, and spent the rest of her money for paper, getting 2 sheets for 1 cent. How many sheets did she buy?

27. Two boys start at the same place and walk in opposite directions, one 12, the other 8 rods; they then turn and walk half way back to the place of starting. How far apart are they?

28. William had 17 figs. He ate 3 and divided the remainder equally between his two brothers. How many did each receive ?

29. I received 11 letters on Friday, and 7 on Saturday. I have answered half of them and 2 letters more. How many letters remain unanswered ?

30. Burt has 5 marbles, Reed has 1 less than Burt, and Prince has 3 more than Burt. How many marbles have all ?

31. I have just read 12 pages in my history, which is 4 fifths of the whole chapter. How many pages are there in the chapter ?

32. If you have 12 chestnuts, and give 1 third of them to Dora, 1 fourth to Annie, and 1 sixth to William, how many will you have left ?

33. How many buttons are there in one dozen and a half dozen buttons ?

34. If you take 2 thirds of 18 from 5 sixths of 18, how many will be left ?

Exercise in Making Examples.

22. The pupils may make examples, putting in items as given below: [See page 169.]

2 dimes and 4 cents; 4 pencils and 12 cents; 3 gallons and 2 pints; 2 hours and 6 cents; 18 cents and 5 oranges; a string 15 feet long.

About boys and years; weeks and days; a spelling lesson; buying groceries; selling lilies.

Imagine you have 3 half-dimes and some cents, and buy with your money any one of the following articles at market prices; make your purchase and tell what change you will get.

Sugar; crackers; soap; dates; cheese; lemons; figs; potatoes; thread; paper; pens; rubber; ink; pins; cotton cloth.

SECTION XII.

ADDITION.

Numbers from one to one hundred.

23. 1. Name in order the numbers from 20 to 40; from 90 to 100.

2. Count by 10's from 10 to 100.

3. How many 10's are there in 20 ? in 30 ? in 60? in 100 ?

4. How many tens and units are there in 22 ? in 25 ? in 32 ? in 45? in 56 ? in 67 ? in 71 ? in 89 ? in 98 ?

5. How many are 10 and 2 ? 20 + 2 ? 40 + 2 ?

6. How many are 10 and 4 ? 30 + 4 ? 50 + 4 ?

7. How many are 10 and 6 ? 40 + 6 ? 60 + 6 ?

8. How many are 10 and 8 ? 30 + 8 ? 70 + 8 ?

9. How many are 10 and 10 ? 20 + 10 ? 80 + 10 ?

10. How many are 40 and 20 ? 60 + 30 ? 30 + 40 ?

11. How many are 15 and 10 ? 75 + 20 ? 25 + 50 ?

24. 12. Jane had 9 peaches and 19 plums, and Thomas gave her 2 more peaches and 2 more plums. How many peaches had she then ? How many plums ?

13. How many are 9 and 2 ? 19 and 2 ?

14. Otis is 8 years old, and his sister is 18. How old will Otis be in 4 years ? How old will his sister be ?

15. How many are 8 and 4 ? 18 and 4 ?

16. Charles bought a slate for 7 cents, and a knife for 17. He sold them so as to gain 5 cents on each. How many cents did he receive for the slate ? for the knife ? How many are 7 and 5 ? 17 and 5 ?

17. John has 6 cents, and Walter has 16. If each boy earns 7 cents more, how many cents will John have then ? How many will Walter have ?

18. Mr. Jenks spent 5 dollars, and Mr. Day spent 15, and each had 9 dollars left. How many dollars had Mr. Jenks at first? How many had Mr. Day?

19. William has 4 cards, and Dora has 14. If each should receive 8 cards more, how many would William then have? How many would Dora have?

25. Give at sight answers to the following:

	i.	ii.	iii.	iv.	v.	vi.
a.	$9+2$	$19+2$	$29+2$	$9+3$	$29+3$	$49+3$
b.	$9+4$	$19+4$	$49+4$	$9+5$	$39+5$	$69+5$
c.	$9+7$	$29+7$	$49+7$	$9+6$	$49+6$	$29+6$
d.	$9+8$	$49+8$	$29+8$	$9+9$	$69+9$	$89+9$
e.	$9+10$	$19+10$	$59+10$			
f.	$8+3$	$18+3$	$38+3$	$8+4$	$28+4$	$38+4$
g.	$8+5$	$28+5$	$48+5$	$8+8$	$38+8$	$48+8$
h.	$8+6$	$38+6$	$58+6$	$8+9$	$48+9$	$68+9$
i.	$8+7$	$38+7$	$68+7$	$8+10$	$28+10$	$78+10$
j.	$7+4$	$17+4$	$27+4$	$7+8$	$37+8$	$47+8$
k.	$7+6$	$37+6$	$57+6$	$7+9$	$27+9$	$67+9$
l.	$7+5$	$27+5$	$37+5$	$7+7$	$67+7$	$87+7$
m.	$7+10$	$67+10$	$77+10$			
n.	$6+5$	$16+5$	$76+5$	$6+9$	$16+9$	$56+9$
o.	$6+7$	$36+7$	$56+7$	$6+8$	$36+8$	$26+8$
p.	$6+6$	$26+6$	$46+6$	$6+10$	$56+10$	$76+10$
q.	$5+6$	$25+6$	$45+6$	$5+8$	$35+8$	$65+8$
r.	$5+9$	$45+9$	$35+9$	$5+10$	$85+10$	$55+10$
s.	$5+7$	$35+7$	$15+7$			
t.	$4+7$	$14+7$	$34+7$	$4+8$	$74+8$	$64+8$
u.	$4+9$	$44+9$	$64+9$	$4+10$	$54+10$	$84+10$
v.	$3+8$	$43+8$	$63+8$	$3+9$	$13+9$	$83+9$
w.	$3+10$	$73+10$	$53+10$	$3+7$		
x.	$2+9$	$42+9$	$82+9$	$2+10$	$32+10$	$72+10$

26. 20. Add by 2's from 2 to 30 ; from 1 to 31.

21. Add by 3's from 3 to 36 ; from 1 to 37 ; from 2 to 38.

22. Beginning with 1 in circle A, add round the circle as far as you can go up to 100, or till directed to stop.
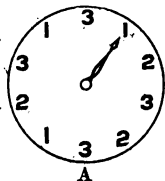
23. Add by 4's from 4 to 48 ; from 1 to 49 ; from 2 to 50.

24. Add by 5's from 5 to 60 ; from 1 to 61 ; from 2 to 62 ; from 3 to 63 ; from 4 to 64.

25. Add by 6's from 6 to 72 ; from 1 to 73 ; from 2 to 74.

26. Beginning with 1 in circle B, add round the circle as near to 100 as you can, or till directed to stop.
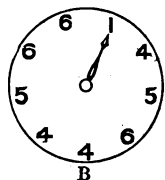
27. Add by 7's from 7 to 84 ; from 1 to 85 ; from 2 to 86.

28. Add by 8's from 8 to 96 ; from 1 to 97 ; from 3 to 99 ; from 5 to 93.

29. Add by 9's from 9 to 99 ; from 1 to 91 ; from 2 to 92.

30. Beginning with 1 in circle C, add round the circle as near to 100 as you can. or till directed to stop.
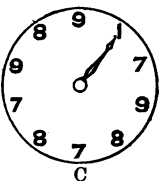
31. There are 15 cows in one pasture, 10 in another, and 20 in another. How many cows are there in all ?

32. Mary spent 50 cents for a hat, 20 cents for trimming it, and 8 cents for the lining. How much did all cost ?

33. Mr. Green worked 20 days in his garden, 6 days in his orchard, and 7 days in his field. How many days did he work in all ?

3

34. If a chair costs 22 dollars, a mat 6 dollars, and a lamp 5 dollars, how much do all cost ?

35. A man bought a stove for 18 dollars, a rope for 4 dollars, and a saddle for 9 dollars.   How many dollars did he pay for all ?

36. Walter had in his library 33 books.   He afterward bought 5, and his cousin gave him 8.   How many books had he then ?

37. At a caucus 35 votes were cast for one person, 10 for another, and 7 for another.   How many votes were cast for all ?

38. A merchant paid 38 dollars for oranges, 6 dollars for bananas, and 7 dollars for lemons.   How many dollars did he pay for all ?

39. A milliner bought 45 black plumes, 8 white, and 9 gray plumes.   How many plumes did she buy ?

40. On board a steamer as passengers were 47 men, 7 women, and 9 children.   How many passengers were there ?

41. A farmer sold 4 cords of pine wood for 27 dollars, and 1 cord of oak for 9 dollars.   How many dollars did he receive ?

42. A farmer sold 53 turkeys to one man, 6 to another, and kept 5 himself.   How many turkeys had he at first ?

43. Sarah had 61 cents left after spending 4 cents for needles, and 6 cents for pins.   How much money had she at first ?

44. A man bought a carriage for 79 dollars, paid 4 dollars for repairing it, and then sold it for 5 dollars more than the carriage and repairing cost him.   How many dollars did he get for it ?

45. Horace is 8 years old, and he is 9 years younger than Clara.   If the teacher is 9 years older than Clara, how old is the teacher ?

46. A cook put 8 pounds of currant juice into a kettle that weighed 12 pounds; she then put in a pound of sugar to each pound of currant juice.   How many pounds did the kettle and its contents weigh ?

SECTION XIII.

SUBTRACTION.

Numbers from one to one hundred.

27. 1. Harold gathered 11 violets and 21 daisies, and threw away 2 flowers of each kind. How many violets had he then ? How many daisies ?

2. How many are 11 less 2 ? 21 less 2 ?

3. Gertrude has 12 dollars and 22 cents. If she should spend 4 dollars and 4 cents, how many dollars would she have left ? How many cents ?

4. How many are 12 less 4 ? 22 less 4 ?

5. A marketman who had 13 quarts of blueberries and 23 quarts of blackberries, sold 6 quarts of each kind. How many quarts of blueberries were left ? How many of blackberries ?

6. How many are 13 less 6 ? 23 less 6 ?

7. A shawl cost 14 dollars, and a dress cost 34 dollars. The cost of each article was 5 dollars more than its worth. What was the worth of the shawl ? of the dress ?

8. How many are 14 less 5 ? 34 less 5 ?

9. Emma had 15 credit marks, and John had 45. If 7 of the credit marks of each were for good behavior, and the rest for perfect lessons, how many of Emma's were for perfect lessons ? How many of John's ?

10. How many are 15 less 7 ? 45 less 7 ?

11. Burt is 16 years old, his mother is 36, and his sister Kate is 8. How many years older is Burt than Kate ? How many years older is his mother than Kate ?

12. How many more are 16 than 8 ? 36 than 8 ?

13. Mr. Elder owed 17 dollars to his grocer, and 47 dollars to his tailor. If he paid 9 dollars to each, how much did he still owe to the grocer ? How much to the tailor ?

28. Give at sight answers to the following:

	i.	ii.	iii.	iv.	v.	vi.
a.	11 − 2	21 − 2	41 − 2	11 − 3	31 − 3	51 − 3
b.	11 − 5	21 − 5	61 − 5	11 − 4	21 − 4	61 − 4
c.	11 − 7	51 − 7	31 − 7	11 − 8	41 − 8	31 − 8
d.	11 − 6	41 − 6	21 − 6	11 − 9	31 − 9	91 − 9
e.	12 − 3	22 − 3	42 − 3	12 − 5	22 − 5	62 − 5
f.	12 − 6	32 − 6	72 − 6	12 − 4	32 − 4	62 − 4
g.	12 − 7	32 − 7	22 − 7	12 − 8	52 − 8	92 − 8
h.	12 − 9	42 − 9	82 − 9	12 − 10	42 − 10	82 − 10
i.	13 − 4	43 − 4	23 − 4	13 − 6	83 − 6	33 − 6
j.	13 − 7	43 − 7	33 − 7	13 − 5	53 − 5	43 − 5
k.	13 − 9	33 − 9	63 − 9	13 − 8	33 − 8	63 − 8
l.	14 − 5	54 − 5	24 − 5	14 − 7	44 − 7	84 − 7
m.	14 − 8	34 − 8	84 − 8	14 − 6	34 − 6	74 − 6
n.	14 − 9	24 − 9	64 − 9	14 − 10	44 − 10	64 − 10
o.	15 − 6	25 − 6	45 − 6	15 − 7	35 − 7	65 − 7
p.	15 − 9	35 − 9	55 − 9	15 − 8	45 − 8	35 − 8
q.	16 − 7	36 − 7	26 − 7	16 − 9	46 − 9	36 − 9
r.	16 − 8	76 − 8	86 − 8	16 − 10	36 − 10	86 − 10
s.	17 − 8	37 − 8	47 − 8	17 − 9	67 − 9	87 − 9
t.	18 − 9	38 − 9	68 − 9	19 − 10	49 − 10	99 − 10

29. 14. Subtract by 2's from 30; from 31.

15. Subtract by 3's from 36; from 37; from 38.

16. Beginning with 1 in circle D, subtract the given numbers from 50, naming results only, and continue subtracting as far as possible.

17. Subtract by 4's from 48; from 49; from 50.

18. Subtract by 5's from 60; from 61; from 62; from 63; from 64.

19. Subtract by 6's from 72; from 73; from 74.

20. Beginning with 1 in circle E, subtract the given numbers from 100, and continue subtracting as far as possible.

E.
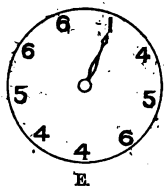
21. Subtract by 7's from 84; from 85; from 86.

22. Subtract by 8's from 96; from 97; from 99; from 93.

23. Subtract by 9's from 99; from 91; from 92.

24. Beginning with 1 in circle F, subtract the given numbers from 100, and continue subtracting as far as possible.

F.
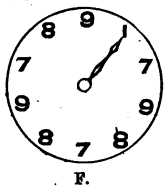
25. From any given number subtract the numbers given in circle G, and continue subtracting as far as possible.

G.
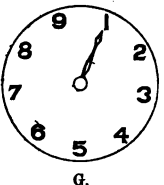
30. 26. In an orchard are 60 trees; 10 are quince trees, 2 are plum trees, and the rest are apple trees. How many are apple trees?

27. Margaret had 40 eggs in a basket, but she fell and broke 10 of them; she afterwards sold 6. How many eggs had she left?

28. In a farm-yard are 70 fowls; of these 10 are turkeys, 10 geese, 5 ducks, and the rest hens. How many are hens?

29. A miller bought some wheat for 65 dollars, but, it being damaged, he sold it for 8 dollars less than he paid. For how much did he sell it?

30. A farmer had 30 sheep to shear. He sheared 9 and his son sheared 3. How many had he then to shear?

31. George had 64 oranges in his basket. If he sold 5 to one person, and 6 to another, how many had he left after each sale?

32. From a branch containing 41 acorns, Emily picked 7 and Olive picked 5. How many acorns remained?

33. In a book Grace found 36 pictures, 8 of which were pictures of birds, 7 of flowers, and the rest of quadrupeds. How many were pictures of quadrupeds?

✗ 34. Out of a tea set of 56 pieces, 7 cups, 5 plates, and 2 saucers were broken. How many pieces were whole?

35. A lad started to walk 47 miles. He walked 9 miles before dinner, 7 after dinner, and rode the rest of the way. How far did he ride?

36. Charles and James were 74 yards apart, and started to walk towards each other. Charles walked 6 yards, and James 7. How far apart were they then?

37. Alfred had 44 sticks of wood to split, and 2 boys came to help him. One split 7 sticks, and the other 5. How many sticks remained for Alfred to split?

38. Horace gathered 62 pond lilies, gave 5 to Alice, 9 to Ruth, and took the rest home. How many did he take home?

39. Arthur earned 65 cents. After spending 8 cents for paper, 6 for a pencil, and 8 for rubber, he put what he had left, into his savings bank. How many cents did he put into the bank?

40. Mr. Grant paid 38 dollars for 3 carriage robes. For one he paid 5 dollars, and for another 8 dollars. How many dollars did he pay for the third?

41. An orphan asylum contained 92 children. After 9 of them were placed in families, and 5 were put out to learn trades, how many remained?

42. A merchant had 84 pieces of sheeting. He sold 8 pieces to one person, 9 to another, and 5 to another. How many pieces were left after each sale?

43. Of a school of 42 pupils, 9 recite the first hour, 8 study geography, and the rest draw. How many draw?

44. A drover who had 56 sheep has sold 9 of them. How many must he now buy to have 50?

SECTION XIV.

ADDITION AND SUBTRACTION.

31. 1. Fifty-seven pupils are now in their seats, 12 have left school, and 3 are absent. How many pupils have belonged to the school ?

2. In Albert's book-case are 63 books ; 5 are books of travel, 8 of poetry, 5 of fiction, and the rest are story books. How many are story books ?

3. Mr. Day owed 62 dollars to the carpenter, 8 to the grocer, and 9 to the shoemaker. How many dollars did he owe to all ? If Mr. Day should pay the grocer and 6 dollars of the carpenter's bill, how much would he then owe ?

4. Ralph spent 45 cents for fish lines, 40 cents for a pole, and 9 cents for hooks. How many cents did he spend ?

5. The third of July, John paid for fire crackers 72 cents, for pin wheels 10 cents, for a bunch of serpents 9 cents, for a slow match 6 cents. How much did he pay for all ?

6. There were 64 planks sawed out of one log, 8 out of another, and 9 out of a third. How many planks were there in all? Seven of these planks were used in repairing a bridge; how many were left ?

7. In a farm yard were 81 chickens, 7 hens, and 5 turkeys. How many fowls were in the yard ? A hawk took away 3 of the chickens, and a fox carried off 4 of the hens. How many fowls remained ?

8. There were 67 pigeons on one tree, and 7 on another ; but 8 of the pigeons flew away. How many were left ?

9. Philip has bought a book for 40 cents, a pencil for 6 cents, some ink for 8 cents, and an inkstand for 10 cents. If he gives a dollar in payment, how many cents should be returned to him ?

10. A man cut in one lot 29 cords of wood, in another 7, and in another 5. If he sold 4 cords to one person, and 3 to another, how many cords had he remaining ?

11. On Friday Mrs. Dole made a plain skirt for 55 cents, some button holes for 20 cents, and hemmed a handkerchief for 8 cents. How much did she earn in all ?

12. Out of 83 cents, Mrs. Dole spent 10 cents for bread, 5 cents for milk, 7 cents for herrings, and 9 cents for potatoes. How much money had she left ?

13. How many are $47 + 2 + 6 + 3 - 7 - 6$?

14. How many are $65 + 2 + 6 + 4 + 8 - 6 - 7$?

15. How many are $59 + 5 + 8 + 7 + 4 - 5 - 8$?

16. How many are $72 + 5 + 4 + 8 + 6 - 7 - 9$?

32. 17. Grace received 26 cents on Monday and 15 cents on Tuesday. How many cents did she receive ?

How many are 26 and 15 ?

Solution. 26 and 10 are 36, and 5 more are 41. *Ans.* 41 cents.

18. I planted 17 flower seeds in one box, and 25 in another. How many seeds did I plant ?

19. How many currant bushes in 2 rows, if there are 19 in the first row, and 33 in the second ?

20. A train due in New York at 36 minutes past 7, was 18 minutes late. At what time did it arrive ?

21. A florist sold 38 plants to one person, and 43 to another. How many did he sell to both ?

22. How many are 36 and 15 ? $26 + 35$? $34 + 27$?

23. How many are 47 and 26 ? $28 + 27$? $25 + 18$?

24. How many are 18 and 33 ? $19 + 57$? $27 + 29$?

25. How many are 14 and 47 ? $38 + 46$? $39 + 27$?

26. How many are 22 and 19 ? $46 + 29$? $54 + 28$?

27. How many are 35 and 27 ? $15 + 28$? $47 + 36$?

28. How many are 39 and 48 ? $45 + 39$? $69 + 14$?

29. How many are 58 and 28 ? $39 + 23$? $26 + 58$?

30. Mr. Todd rode 32 miles on the railroad, 27 miles in a stage, and 18 miles in his own carriage. How many miles did he ride in all ?

How many are 32 and 27 and 18 ?

Solution. 32 and 20 are 52, and 7 more are 59. 59 and 10 are 69, and 8 more are 77. *Ans.* 77.

31. Florence, Julia, and Grace dressed dolls for a fair. Florence dressed 18 dolls, Julia dressed 26, and Grace dressed 25. How many dolls did all dress ?

32. In trimming a school-hall, Jane used 18 yards of twine, Mary used 27 yards, and John used 19 yards. How many yards of twine did all use ?

33. How many are $41 + 25 + 37$? $22 + 35 + 24$?

34. How many are $24 + 38 + 19$? $33 + 18 + 38$?

35. How many are $45 + 17 + 28$? $48 + 29 + 39$?

36. How many are $16 + 37 + 46$? $27 + 36 + 18$?

33. 37. A stove dealer paid 25 dollars for a furnace, put 2 dollars' worth of work upon it, and then sold it for 42 dollars. How many dollars did he gain ?

How many are 42 less 27 ?

Solution. 42 less 20 are 22, less 7 more are 15. *Ans.* 15.

38. Philip and Hector hired a carriage for 75 cents. Philip paid 42 cents of the money, and Hector paid the rest. How many cents did Hector pay ?

39. I left home at 27 minutes past 5 o'clock, and returned at 45 minutes past 5. How many minutes was I gone ?

40. Lecture commenced at 7 : 30 ; a person entered the hall at 7 : 42. How many minutes late was he ?

41. How many are 23 less 14 ? $53 - 18$? $33 - 17$?

42. How many are 44 less 16 ? $64 - 25$? $34 - 15$?

43. How many are 35 less 18 ? $35 - 16$? $45 - 26$?

44. How many are 46 less 27 ? $76 - 49$? $66 - 29$?

45. How many are 57 less 38 ? $84 - 28$? $57 - 39$?

46. How many are 68 less 29 ? $93 - 47$? $83 - 45$?

47. Margaret read 38 pages of history on Monday, and 28 on Tuesday. How many pages did she read on both days?

48. A man having 55 dollars, paid 16 dollars to one person and 18 to another. How much money had he left?

49. There are 92 days in the Spring months. March has 31 days, April 30, and May the remainder. How many days has May?

50. Thirty-nine pupils belong to Mrs. Willard's class in geography. If 5 draw maps, 17 recite at the board, and the rest at their seats, how many recite at their seats?

51. In a gale a church steeple 28 feet high above the roof was blown away. If the roof of the church was 54 feet above the ground, how high was it to the top of the steeple before the gale?

52. Suppose a vessel sails 31 miles east, and then 16 miles west, in what direction and how far will she then be from where she first started?

53. How much less than 100 is 57 plus 29?

54. James had 87 cents, and paid for a slate 12 cents, and for a basket 17 cents. How many cents had he left?

55. Some boys caught 19 perch, 12 carp, 11 pickerel, and 9 eels. How many fishes did all catch? They threw away 14 of the fishes, gave 17 to Mrs. Stowe, and sold the remainder. How many did they sell?

56. George sold 9 pears for 18 cents, 21 for 25 cents, and 24 for 36 cents. How many pears did he sell? How much did all bring?

57. Horace had two 25-cent pieces, two 10-cent pieces, one 5-cent piece, and 3 cents, with which he bought a drawing-book worth 37 cents, a pencil worth 6 cents, and a ruler worth 12 cents. How many cents had he remaining?

58. Mr. Otis is 65 years old and his wife is 57. How old was Mr. Otis when his wife was 38?

☞ For drill exercises in addition and subtraction, the teacher is referred to pages 161 – 163.

SECTION XV.

MULTIPLICATION.

34. 1. Add by 2's from 2 to 24. The numbers you have just named, which are made up of 2's, are multiples of 2.

2. Repeat the table of 2's, thus: one 2 is 2; two 2's are 4; three 2's are 6, etc. [For Tables, see page 172.]

3. How many are ten 2's? twelve 2's? eleven 2's?

4. Name the multiples of 3 to 36.

5. Repeat the table of 3's.

6. How many are seven 3's? nine 3's? eight 3's? ten 3's? 12 times 3? 11 times 3?

7. Name the multiples of 4 to 48.

8. Repeat the table of 4's.

9. How many are six 4's? eight 4's? ten 4's? seven 4's? 9 times 4? 11 times 4? 12 times 4?

10. Name the multiples of 5 to 60.

11. Repeat the table of 5's.

12. How many are five 5's? seven 5's? six 5's? ten 5's? 8 times 5? 9 times 5? 12 times 5? 11 times 5?

13. At 2 cents apiece, what is the cost of 12 postage stamps?

14. At 2 for a cent, how many cakes can you buy for 10 cents?

15. If you study 3 hours a day for 9 days, how many hours will you have studied?

16. At 3 for a cent, how many needles can you buy for 8 cents? for 11 cents?

17. How many pint cups can be filled with 11 quarts of milk?

18. How many feet in 1 yard? in 7 yards and 2 feet?

19. Harry has a rectangular flower-bed 5 feet long, and 4 feet wide. How many feet of fencing would fence the sides ? the ends ?

20. Ella embroiders 4 scollops every working day. How many scollops does she embroider in a week ? in a fortnight ?

21. Charles had 7 cents, and Laura had 4 cents. How many apples could each buy at the rate of 4 for a cent ?

22. A triangle has 3 sides and 3 angles. How many sides do 8 triangles have ? How many angles do 9 triangles have ?

23. A square has 4 equal sides. How many lines will be required to make 8 separate squares ?

24. How many lines will be required to make 10 separate triangles ?

25. If 1 fork has 4 tines, how many tines have a half dozen forks ?

26. Luke exchanges 6 apples for walnuts at the rate of 5 walnuts for an apple. How many walnuts does he receive ?

27. There are 5 school days in a week. How many school days are there in a term of 12 weeks ?

28. Mary has attended school 7 weeks and 3 days. Reckoning a week 5 days, how many days has she attended ?

29. How many halves are there in 1 apple ? in 10 apples ? in 12 apples and a half ?

30. How many thirds are there in 1 cake ? in 10 cakes ? in 8 cakes and 2 thirds of another cake ?

31. How many thirds of a yard can be cut from a piece of cloth containing 9 and 1 third yards ?

32. How many fourths or quarters are there in 1 yard ? How many quarters are there in 5 and 1 quarter yards ? In 6 and 3 quarters yards ? In 8 and 2 quarters yards ?

33. James had 7 sheets of paper, which he cut in quarters. How many quarter sheets had he ?

34. How many fifths are there in 1 orange ? in 5 oranges ?

35. Just enough boys went sleigh-riding to cost 6 dollars, each boy paying 1 fifth of a dollar. How many boys went ?

35. 36. Count from one hundred to one hundred and ten; from one hundred thirty, to one hundred fifty.

37. Read the following numbers: 102; 116; 125; 138; 145; 107.

38. In which place from the right are the hundreds written?

39. Name the multiples of 6 to 72.

40. Repeat the table of 6's.

41. How many are eight 6's? five 6's? seven 6's? nine 6's? 11 times 6? 10 times 6? 12 times 6?

42. Name the multiples of 7 to 84.

43. Repeat the table of 7's.

44. How many are eight 7's? ten 7's? nine 7's? eleven 7's? six 7's? seven 6's? 5 times 7? 7 times 5? 12 times 7?

45. Name the multiples of 8 to 96.

46. Repeat the table of 8's.

47. How many are five 8's? seven 8's? nine 8's? eleven 8's? 8 times 8? 12 times 8? 6 times 8?

48. Name the multiples of 9 to 108.

49. Repeat the table of 9's.

50. How many are four 9's? six 9's? eight 9's? eleven 9's? 5 times 9? 9 times 5? 7 times 9? 12 times 9?

51. John can buy 6 marbles for a cent. How many marbles can he buy for 3 cents? for 10 cents?

52. There are 6 working days in a week. How many working days are there in a fortnight? in 4 weeks?

53. If a horse eats 7 quarts of oats in a day, how many quarts will he eat in a week?

54. At 8 cents each, what must I pay for 6 hyacinths?

55. At 9 cents each, what must I pay for 3 tops?

56. At 7 cents a quart for milk, what will be the cost of 3 quarts? of a gallon? of 2 gallons and 3 quarts?

57. How many quarts are there in 1 peck ? in 3 pecks ? in a bushel ?

58. At 9 cents a quart, what will a peck of berries cost ? What will a peck and 4 quarts cost ?

59. If 3 men can dig a ditch in 6 days, in how many days can 1 man dig the same ?

60. If 6 grates consume a ton of coal in 8 days, how many days would a ton last 1 grate at the same rate ?

61. In a hop-field there were 12 rows of hops, and 9 hills in each row. How many hills were there ?

62. In a class there were 8 boys and 3 times as many girls. How many children were in the class ?

63. If a horse-car goes 8 miles in an hour, and a steam-car goes 4 times as far, and you travel an hour in each, how far do you travel ?

64. If it requires 1 yard to make a vest, and 7 yards to make a cloak, how many yards will be required to make 6 vests and 6 cloaks ?

65. John and Philip hired a boat by the hour. If John paid 4 cents an hour, and Philip paid 5, how much did both pay for 2 hours ? for 7 hours ?

66. If a man buys pineapples at 8 cents apiece, and sells them at 15 cents apiece, how much does he gain on 1 pineapple ? on 5 pineapples ?

67. If a boy earns 12 dollars a week, and spends all but 3 dollars, how many dollars does he spend in 4 weeks ?

68. How many sixths of a pie are there in 1 pie ? How many persons can be served with 4 pies, each taking 1 sixth of a pie ? How many can be served with 5 pies and 4 sixths of a pie at the same rate ?

69. At a sixth of a dollar apiece for handkerchiefs, how many handkerchiefs can I buy for 1 dollar ? for 4 dollars ?

70. How many sevenths of a week are there in one week ? in 2 and 1 seventh weeks ? in 4 and 3 sevenths weeks ?

71. How many ninths are there in 1 ? in 2 ? in 6 ?

36. 72. Name the multiples of 10 to 120.

73. Repeat the table of 10's.

74. Name the multiples of 11 to 132.

75. Repeat the table of 11's.

76. How many are twelve 10's? eleven 10's? ten 11's? twelve 11's? eleven 12's?

77. Name the multiples of 12 to 144.

78. Repeat the table of 12's.

79. How many are eight 12's? five 12's? seven 12's? eleven 12's? 6 times 12? 9 times 12? 12 times 12?

80. At 10 cents each, what will 3 lamp chimneys cost?

81. At 10 cents each, what will 2 candles cost? 4 candles? half a dozen candles?

82. If a barrel contains 2 bushels and 3 pecks, how many pecks will fill 2 barrels? 5 barrels?

83. At 11 cents a pint, how much will a dealer receive for a gallon of syrup?

84. How many yards of print will be required for 4 dresses of 12 yards each? of 11 yards each?

85. What will be the cost of 12 tops, at 11 cents each?

86. If 11 plums will pay for 1 orange, how many plums will pay for 7 oranges? for 10 oranges?

87. If a quantity of bread will last 10 persons 5 days, how many persons would the same bread last one day? How many days would the same bread last one person?

88. There are 12 inches in a foot, how many inches are there in 3 feet, or a yard?

89. How many inches long is a floor which is 10 feet long?

90. How many months are there in 1 year? in 2 years and 1 month? in 4 years and 2 months?

91. How many months are there in 6 years and 3 months? in 8 years and 4 months?

92. How many months in 12 years and 6 months?

<div align="center">2 5 4 3 6 8 7 9</div>

37. *a.* Beginning at the left, give at sight the number of halves in each number written above; thus, four, ten, eight, etc.

In the same manner give

b. The number of thirds.　*f.* The number of sevenths.
c. The number of fourths.　*g.* The number of eighths.
d. The number of fifths.　*h.* The number of ninths.
e. The number of sixths.　*i.* The number of tenths.

<div align="center">9 8 5 7 4 3 6 1 2</div>

j. Beginning at the right of the line of figures written above, multiply each number by 2 and add 1 to the product, naming results only; thus, five, three, thirteen, etc.

k. Multiply by 3 and add 2.　*o.* Multiply by 7 and add 6.
l. Multiply by 4 and add 3.　*p.* Multiply by 8 and add 7.
m. Multiply by 5 and add 4.　*q.* Multiply by 9 and add 8.
n. Multiply by 6 and add 5.　*r.* Multiply by 11 and add 9.

38. 93.' How many are two 20's? two 30's? 40's? 50's?
94. How many are two 15's?

Solution. 15 = 10 + 5. Two 10's are 20, and two 5's are 10, which, added to 20, is 30. *Ans.* Two 15's are 30.

95. How many are two 25's? 35's? 45's?
96. How many are three 20's? 30's? 15's? 25's?
97. How many are four 15's? 20's? 25's? 24×4?
98. How many are five 15's? 20's? 16×5? 17×3?
99. How many rods of fencing will be required to enclose a square field, whose sides are 15 rods long?
100. Amy bought 2 yards of lace at 35 cents a yard, and 2 yards at 18 cents a yard. How much did she pay?

☞ For drill exercises in multiplication, see page 164.

SECTION XVI.

MISCELLANEOUS.

39. 1. How much should you pay for 2 rabbits at 12 cents apiece, and 2 pigeons at 10 cents apiece ?

2. A person bought 8 pencils at 6 cents apiece, and 4 quires of paper at 9 cents a quire. How much did he pay for both ?

3. A person bought 6 quarts of vinegar at 7 cents a quart, and 3 pounds of sugar at 9 cents a pound. What did he pay for both ?

4. Solon bought 4 codfish at 9 cents apiece, and 2 mackerel at 8 cents apiece. How much did he pay for all ?

5. What cost 4 heads of lettuce at 10 cents a head, 6 pounds of tomatoes at 5 cents a pound, and 2 pounds of beef at 11 cents a pound ?

6. A newsboy bought 20 papers at 2 cents apiece, and sold them at 3 cents apiece. How many cents did he receive for them ? How many more than he paid ?

7. A merchant tailor had 10 vests. He sold 3 at 2 dollars each, and the remainder at 3 dollars each. How much did he receive for all ?

8. William is 11 years old ; his father is 4 times as old, and 9 years more. How old is his father ?

9. Arthur bought 7 pounds of dates at 12 cents a pound, and had 7 cents left. How many cents had he at first ?

10. Mary has 37 flowers. If she makes 3 bouquets, putting 12 flowers into each, how many flowers will she have left ?

11. Willie has 3 broods of chickens, 2 having 12 chickens each, and the other enough to make 39 chickens in all. How many chickens has the third brood ?

12. Philo had 50 cents; with this money he bought 4 pounds of figs at 12 cents a pound. How many cents had he left?

13. I bought 3 barrels of flour at $11 a barrel, and sold the whole for $40. How many dollars did I gain?

14. If by working 10 hours a day a man can build a fence in 3 days, in how many days can he build it by working 1 hour a day?

15. John can saw a cord of wood in 5 days by working 2 hours each day, but he wishes to saw it in 1 day. How many hours must he work on that day?

16. Two men go from the same place and travel in opposite directions. One travels 3 miles an hour, and the other 4 miles an hour. How far apart will they be at the end of 1 hour? of 2 hours? of 5 hours?

17. Two men start at the same place, and travel in the same direction, one at the rate of 2 miles an hour, and the other at the rate of 12 miles an hour. How far apart will they be in 1 hour? in 2 hours? in 4 hours?

18. Laura earns 72 cents in a day, Ada 60 cents. How much more does Laura earn than Ada in 1 day? in 9 days?

19. Josiah sold 2 quarts of raspberries to Mrs. Lamb for 27 cents, and 3 quarts to Mrs. Hewins at 11 cents a quart. How many cents did he receive for his raspberries?

20. A merchant had 7 barrels of flour: he sold 5 barrels at $12 a barrel, and the remainder at $11 a barrel. How much did he receive for the lot?

21. Alfred had 63 cents; he paid 20 cents for a basket, and bought 3 apples at 2 cents apiece. How many cents had he left?

22. Joseph distributed 5 hundred handbills at 10 cents a hundred, receiving in payment 4 pounds of rice at 9 cents a pound, and the rest in money. How much money did he receive?

23. A merchant bought 6 barrels of pork at $12 a barrel, and gave in payment 5 cords of wood at $11 a cord, and the rest in money. How many dollars did he pay in money?

24. If you should earn 10 cents an hour for 5 hours every day, how many cents would you earn from Monday morning to Wednesday night?

25. A gardener set out 5 rows of strawberry plants 13 in a row, and 6 plants besides. How many plants did he set?

26. If you should earn 40 dollars a month and spend 29, how many dollars would you save in a year?

27. In a hall are 12 settees with 5 persons on each, 4 with 8 persons on each, 3 with 4 persons on each, and 5 people are standing. How many are in the hall?

28. What is the sum of the ages of 6 boys each 8 years old, 5 boys each 9 years old, and 2 boys each 10 years old?

29. What is the cost of 3 knives at 25 cents each, 2 boxes of pens at 30 cents each, and 1 quire of paper at 12 cents?

30. On Monday Gilbert earned 20 cents; on Tuesday he earned twice as much as on Monday; and on Wednesday as much as he earned on Monday and Tuesday both. How much did he earn in all?

31. Multiply the sum of 5 and 9 by their difference.

32. Three 5's, plus 4, plus 2, less 7, are how many?

33. Four 3's, less 9, multiplied by 6, less 2, are how many?

34. How many are 5 multiplied by 7, less 2, less 9, plus 6?

35. How many are 6 multiplied by 5, plus 7, less 9?

36. Multiply 5 by 4, add 2, add 2, subtract 6, subtract 3, subtract 8, multiply by 2, add 3. How many have you?

37. Take 7, add 3, multiply by 5, subtract 20, add 5, take away 9, subtract 8, add 3. How many have you?

38. Think of any number less than 8, multiply that number by 4, add 4, subtract 3 times the number you thought of, add 7, add 1, add the number you thought of, take away 7, subtract twice the number you thought of. What number have you?

SECTION XVII.

FACTORS AND MULTIPLES.

40. 1. What two numbers multiplied together make 12 ? The numbers you have named are *factors* of 12.

Note. — The word factor means a *maker.* So a factor of a number is any number which, being multiplied, will *make* that number.

2. Name two factors of 12 different from those you first named.

3. Name any factor of 10. Name two factors of 6.

4. Name two factors of 24. What other factors has 24 ?

Name two factors which, multiplied together,

5. Make 48; 63; 4; 42; 64.
6. Make 10; 21; 60; 81; 9.
7. Make 18; 70; 15; 20; 49.
8. Make 32; 72; 8; 24; 14.
9. Make 12; 30; 35; 80; 56.
10. Make 90; 28; 54; 45; 50.

What is the largest multiple

11. Of 2 in 7 ? in 15 ? in 19 ? in 23 ?
12. Of 3 in 10 ? in 20 ? in 26 ? in 37 ? in 31 ? in 29 ?
13. Of 4 in 17 ? in 25 ? in 31 ? in 37 ? in 45 ? in 50 ?
14. Of 5 in 27 ? in 32 ? in 39 ? in 46 ? in 58 ? in 63 ?
15. Of 6 in 31 ? 28 ? 45 ? 37 ? 57 ? 64 ? 50 ?
16. Of 7 in 25 ? 38 ? 29 ? 46 ? 51 ? 60 ? 72 ? 86 ?
17. Of 8 in 27 ? 35 ? 46 ? 81 ? 63 ? 65 ? 74 ? 51 ? 90 ? 100 ?
18. Of 9 in 22 ? 30 ? 50 ? 40 ? 74 ? 65 ? 86 ? 97 ? 100 ? 109 ?
19. Of 11 in 26 ? 38 ? 59 ? 45 ? 69 ? 89 ? 82 ? 100 ? 122 ?
20. Of 12 in 27 ? 49 ? 38 ? 70 ? 85 ? 99 ? 110 ? 133 ? 150 ?

21. Of 15 in 45 ? 63 ? 80 ?
22. Of 20 in 72 ? 84 ? 105 ?
23. Of 25 in 70 ? 80 ? 110 ?
24. Of 40 in 90 ? 130 ?
25. Of 50 in 75 ? 130 ?
26. Of 60 in 90 ? 200 ?

SECTION XVIII.

DIVISION.

41. 1. If each step you take is 2 feet in length, how many steps do you take in walking 20 feet ? 22 feet ? How many steps must you take to measure 40 feet ?

2. How many times must I apply a 2-foot rule to measure 16 feet ? 24 feet ?

3. I have a basket that holds just 3 pints. How many times must I fill it to measure 18 pints ? 24 pints ?

4. How many yards are there in 27 feet ? in 33 feet ?

5. How many gallons are there in 32 quarts ? in 40 quarts ?

6. How many armfuls of 4 sticks each must be taken away to remove a pile of 48 sticks ? of 44 sticks ?

7. In a procession are 36 boys walking in ranks of 4 boys each. How many ranks are there ?

8. If the 36 boys should walk in ranks of 6 boys each, how many ranks would there be ?

9. If the 36 boys should walk in ranks of 9, how many ranks would there be ?

10. If it is 5 feet round the rim of a wheel, how many times must the wheel turn in going 45 feet ? 55 feet ?

11. How many ferry-tickets at five cents each can you buy for 25 cents ? for 50 cents ?

12. If a horse can go a mile in 5 minutes, how many miles can he go in an hour, or 60 minutes ?

13. If you exchange 24 figs for lemons, at the rate of 6 figs for 1 lemon, how many lemons do you get ?

14. Allowing 6 paces to a rod, how many rods are there in 48 paces ? in 72 paces ?

15. How many 6's are there in 42 ? in 54 ? in 66 ?

16. How many weeks are there in 28 days ? in 63 days ?

17. A man owned a lot of land having a frontage of 84 rods. Into how many house-lots, each having a frontage of 7 rods, could he divide it ?

18. How many 7's are there in 35 ? in 49 ? in 42 ?

19. At 7 cents a yard, how many yards of print can be bought for 56 cents ? for 77 cents ?

20. A glazier used 40 panes of glass, putting 8 panes into each window. How many windows were glazed ?

21. Horace has dug enough potatoes to fill a peck basket 32 times. How many bushels has he dug ?

22. How many 8's are there in 24 ? in 48 ? in 56 ?

23. In 64 gills how many quarts ? How many gallons ?

24. How many 9's are there in 27 ? in 63 ?

25. If 1 cent will buy 9 crackers, how many cents will buy 54 crackers ? 81 crackers ? 72 crackers ?

26. If one buffalo robe can be bought for 9 dollars, how many robes can be bought for 108 dollars ?

27. How many 10-cent pieces equal 40 cents ? 90 cents ?

28. Mary is 11 years old and her father is 44 years old. How many times as old as Mary is her father ?

29. Eleven half-yards make a rod. How many rods are there in 33 half-yards ?

30. How many 11's are there in 22 ? in 110 ? in 121 ?

31. Sarah can knit 12 times around her stocking in 1 hour. In how many hours can she knit 48 times around ? 60 times around ? 72 times ?

32. If Charles can earn 12 cents in an hour, how many hours must he work to earn enough to buy a sled worth 120 cents ?

33. How many rooms, each 12 feet wide, can there be on one side of a hall 84 feet long ?

34. How many years in 96 months ? in 108 months ?

35. At the rate of a mile in 12 minutes, how many miles can a dog trot in 1 hour ?

36. How many 12's are there in 144 ? in 132 ?

42. Give at sight answers to the following :

	i.	ii.	iii.	iv.
a.	$21 = 3 \times ?$	$36 = ? \times 6$	$54 = 6 \times ?$	$81 = 9 \times ?$
b.	$22 = 2 \times ?$	$36 = 9 \times ?$	$55 = 5 \times ?$	$84 = ? \times 7$
c.	$24 = ? \times 2$	$36 = 3 \times ?$	$56 = ? \times 7$	$88 = 8 \times ?$
d.	$24 = 3 \times ?$	$40 = ? \times 4$	$60 = 5 \times ?$	$90 = ? \times 9$
e.	$24 = 6 \times ?$	$40 = 8 \times ?$	$60 = ? \times 6$	$96 = 8 \times ?$
f.	$25 = ? \times 5$	$42 = 7 \times ?$	$63 = 9 \times ?$	$99 = 9 \times ?$
g.	$27 = ? \times 9$	$40 = 5 \times ?$	$64 = ? \times 8$	$100 = ? \times 10$
h.	$28 = 7 \times ?$	$44 = ? \times 4$	$66 = 6 \times ?$	$108 = ? \times 9$
j.	$30 = ? \times 5$	$45 = ? \times 9$	$70 = ? \times 7$	$110 = 11 \times ?$
k.	$30 = 3 \times ?$	$48 = ? \times 4$	$72 = ? \times 6$	$120 = ? \times 12$
l.	$32 = 8 \times ?$	$48 = 6 \times ?$	$72 = 8 \times ?$	$121 = 11 \times ?$
m.	$33 = 3 \times ?$	$49 = ? \times 7$	$77 = 7 \times ?$	$132 = 12 \times ?$
n.	$35 = ? \times 7$	$50 = ? \times 5$	$80 = ? \times 8$	$144 = ? \times 12$
o.	$42 = 6 \times ?$	$48 = 8 \times ?$	$63 = 7 \times ?$	$132 = 11 \times ?$
p.	$54 = 9 \times ?$	$56 = ? \times 8$	$72 = ? \times 9$	$108 = ? \times 12$
q.	$84 = ? \times 12$	$96 = 12 \times ?$	$60 = 12 \times ?$	$110 = 10 \times ?$
r.	$26 = 2 \times ?$	$40 = 2 \times ?$	$50 = 25 \times ?$	$75 = 15 \times ?$
s.	$28 = ? \times 2$	$42 = ? \times 3$	$51 = 3 \times ?$	$75 = 3 \times ?$
t.	$30 = ? \times 15$	$45 = 3 \times ?$	$52 = ? \times 13$	$80 = ? \times 2$
u.	$32 = 16 \times ?$	$48 = ? \times 3$	$60 = 4 \times ?$	$90 = 3 \times ?$
v.	$36 = 2 \times ?$	$52 = 4 \times ?$	$60 = ? \times 3$	$96 = 24 \times ?$
w.	$39 = ? \times 3$	$50 = ? \times 2$	$65 = 5 \times ?$	$100 = ? \times 4$

43. 37. How many aprons, each containing 2 yards, can Mrs. Adams make from 25 yards of cambric, and how many yards will she have left ?

38. If Mr. Kane puts 5 pounds of butter into each box, how many boxes can he fill with 62 pounds, and how many pounds will be left ?

39. How many quarts are there in 23 pints ?

40. How many gallons in 38 quarts ? in 51 quarts ?

41. How many bushel baskets can be filled with 50 pecks of beans ?

42. How many peck baskets can be filled with 60 quarts of cranberries ? How many quarts must a basket hold to contain the remainder ?

43. At 6 cents each, how many pencils can you buy for 50 cents ?

44. How many dozen eggs are there in 80 eggs, and how many eggs besides ?

45. If you buy as many handkerchiefs at 10 cents each as you can for 75 cents, and spend the rest of the money for thread, how much do you spend for thread ?

46. Owing 42 dollars, Mrs. Green paid as much of the debt as possible in 5-dollar bills and the rest in 1-dollar bills. How many bills of each sort did she use ?

47. If a builder has 37 sashes, and uses 3 to a window, how many windows can he furnish, and how many sashes will remain ?

48. In January, which has 31 days, are how many full weeks, and how many days beside ?

49. Suppose 1 pound of coffee to measure 38 table-spoonfuls, and 5 table-spoonfuls to be used every day, how many days will 1 pound last, and how many spoonfuls will be left ?

44. Give at sight answers to the following :

	i.	ii.	iii.	iv.	v.
a.	8 + 7	12 × 10	90 ÷ 6	96 ÷ 8	72 ÷ 9
b.	17 − 9	6 + 9	65 + 28	16 × 5	18 + 16
c.	8 × 7	9 × 8	83 − 19	108 ÷ 12	8 × 6
d.	28 ÷ 4	8 + 9	7 × 6	83 − 18	26 − 19
e.	132 ÷ 11	63 ÷ 7	54 ÷ 6	56 ÷ 7	34 + 17
f.	9 × 7	11 × 12	75 ÷ 3	64 − 27	65 ÷ 5
g.	56 ÷ 8	13 − 8	55 − 17	45 ÷ 5	16 + 37
h.	11 × 11	15 − 8	13 × 4	72 ÷ 8	9 × 12
j.	39 − 12	72 ÷ 12	37 + 15	67 + 28	43 − 17

SECTION XIX.

MULTIPLICATION AND DIVISION.

45. 1. George sold 6 boxes at 3 cents apiece; how many cents did he receive for them? With the money he received he bought oranges at 2 cents apiece; how many oranges did he buy? Six 3's equal how many 2's?

2. If I exchange ten 3-cent postage-stamps for 2-cent stamps, how many 2-cent stamps do I receive? Ten 3's equal how many 2's?

3. How many 5-cent pieces would it take to pay for 10 cream-cakes at 3 cents apiece? Ten 3's equal how many 5's?

4. Mr. Dow can walk 4 miles an hour; his horse can go 8 miles an hour. By walking, Mr. Dow can reach a certain place in 6 hours; how long will it take him if he rides? Six times 4 equals how many times 8?

5. How many 10-dollar bills will it take to pay for 12 pairs of boots at 5 dollars a pair?

6. I exchanged 2 lawn mowers at 12 dollars each for harnesses at 8 dollars a set. How many sets did I get?

7. How many rows of trees, having 6 trees in each row, can be set from 4 rows having 12 trees in each row?

8. How many pounds of cheese, at 9 cents a pound, will pay for 3 tumblers, at 12 cents each?

9. If a horse travels 6 miles an hour, in how many hours can he travel as far as a railway train can go in 3 hours, the latter going at the rate of 20 miles an hour?

10. When chestnuts are worth $5 a barrel, and coal $10 a ton, how many barrels of chestnuts will pay for 6 tons of coal?

11. If 4 eggs are required for a pound of cake, how many pounds can be made with 3 dozen eggs?

12. Mr. Simms can build a chimney in 12 days by working 6 hours a day. How many days will it take him if he works 9 hours a day ?

13. How many hours' work, at 10 cents an hour, will pay for 5 yards of crash, at 12 cents a yard ?

14. A newsboy sold 12 papers at 3 cents apiece, and 3 papers at 4 cents apiece. With the money he received he bought meat at 8 cents a pound. How many pounds of meat did he buy ?

15. A man spends for car-tickets 30 cents a day, the tickets being 5 cents each. How many tickets does he buy in 6 days ?

16. Mr. Cook has a jug which it costs 56 cents to get filled with syrup worth 7 cents a quart ; how many quarts does it hold ? How many quarts will it take to fill the jug 8 times ?

17. I wish to curtain 4 windows with muslin, having 2 curtains to each window. If each curtain is 3 yards long, how many yards must I buy, and how many dollars shall I pay for it, at the rate of 1 dollar for every 4 yards ?

18. If cherries are 8 cents a quart and 50 cents a peck, how much money do I save by buying half a peck of cherries at once, instead of buying the same quantity by the quart ?

19. Find the cost of materials for a quart of lemon-jelly, if to make 3 pints it requires 1 box of gelatine at 25 cents, 4 lemons at 15 cents a dozen, and half a pound of sugar at 12 cents a pound.

20. How many melons at 25 cents each can Sidney get for 9 doves at 8 cents each and a chicken worth 30 cents ?

21. Mr. Grey sold 6 pairs of boots at 5 dollars a pair and 2 pairs at 3 dollars, and took his pay in hides at 4 dollars apiece. How many hides did he get ?

22. Five 12's equal how many 10's ? how many 6's ?

23. Four 10's equal how many 5's ? how many 8's ?

24. Three 10's equal how many 6's ? how many 5's ?

25. Nine 8's equal how many 12's ? how many 6's ?

SECTION XX.

DIVISION.

46. 1. James and John hired a boat together, agreeing to share the cost equally. If the cost was 24 cents, how many cents should each pay?

By what do you divide to find 1 half of a number?

2. What is 1 half of 22? of 26? of 28?

3. Hattie had 40 cents, and spent half of her money for a slate. What was the cost of her slate?

4. What is 1 half of 60? of 80? of 100?

5. What is 1 half of 30? of 50? of 90? of 70?

6. What is the length of 1 half of a cord 25 feet long?

7. What is 1 half of 21 inches? of 23 inches?

8. What is 1 half of 33? of 45? of 65?

9. Three girls divided 24 yards of ribbon equally among themselves. How many yards did each receive?

By what do you divide to find 1 third of a number?

10. If 25 yards had been divided equally among the 3 girls, what would have been the share of each?

11. What is 1 third of 27? of 30? of 36? of 63?

12. What is 1 third of 28? of 32? of 37? of 65?

13. What is 1 third of 60? of 90? of 63? of 66?

14. What is 1 third of 93? of 99? of 45? of 75?

15. Mr. Hewins divided 28 acres of land equally among his 4 sons. How many acres did each son receive?

16. If Mr. Hewins divided 30 acres of land equally among his 4 daughters, what was the share of each?

17. What is 1 fourth of 24? of 32? of 36? of 44? of 40?

18. What is 1 fourth of 25? of 33? of 39? of 46? of 41?

19. What is 1 fourth of 60? of 80? of 84? of 88? of 100?

20. A team is driven 35 miles in 5 hours.   What distance does it go in 1 hour ?

21. Five men shared 33 dollars equally among themselves. What was each man's share ?

22. What is 1 fifth of 25 ? of 45 ? of 50 ? of 60 ? of 55 ?

23. What is 1 fifth of 26 ? of 47 ? of 53 ? of 64 ? of 57 ?

24. If 1 man can do a piece of work in 18 days, how long will it take 6 men to do it ?

25. If a teacher earns 29 dollars in 6 days, how much can he earn in 1 day ?

26. What is 1 sixth of 30 ? of 42 ? of 54 ? of 66 ? of 72 ?

27. What is 1 sixth of 32 ? of 43 ? of 59 ? of 67 ? of 74 ?

28. When the board for a family is 42 dollars a week, what is the price per day ?

29. Mr. James earns 30 dollars a month.   If he saves 1 seventh of what he earns, how much does he save ?

30. What is 1 seventh of 49 ? of 63 ? of 70 ? of 77 ? of 84 ?

31. What is 1 seventh of 50 ? of 65 ? of 72 ? of 80 ? of 90 ?

32. If with 1 team a gravel knoll can be removed in 32 days, in how many days can it be removed with 8 teams ?

33. If 1 man can do a piece of work in 44 hours, how long will it take 8 men to do it ?

34. What is 1 eighth of 24 ? of 56 ? of 72 ? of 64 ? of 88 ?

35. What is 1 eighth of 25 ? of 60 ? of 75 ? of 65 ? of 90 ?

36. When 9 chairs cost 27 dollars, what does 1 chair cost ?

37. If 9 persons are allowed 40 pounds of flour for a given time, what is the allowance of each person ?

38. What is 1 ninth of 45 ? of 54 ? of 72 ? of 81 ? of 99 ?

39. What is 1 ninth of 46 ? of 57 ? of 73 ? of 83 ? of 106 ?

40. At ten cents a dozen, how many dozen cocoa-nut cakes can you pay for with 30 cents ? with 65 cents ?

41. What is 1 tenth of 60 ? of 50 ? of 80 ? of 70 ? of 90 ?

42. What is 1 tenth of 61 ? of 55 ? of 83 ? of 72 ? of 96 ?

43. What is 1 eleventh of 33 ? of 44 ? of 66 ? of 77 ? of 88 ?
44. What is 1 eleventh of 38 ? of 50 ? of 67 ? of 79 ? of 90 ?
45. What is 1 twelfth of 36 ? of 48 ? of 72 ? of 60 ? of 96 ?
46. What is 1 twelfth of 42 ? of 53 ? of 79 ? of 69 ? of 100 ?

47. 47. If 44 men are separated into 2 equal parties, how many men are in each party ?

48. When 4 dollars are paid for 36 yards of wire screen, how many yards will 1 dollar buy ?

49. Otis took 48 bushels of turnips to market in 4 equal loads. How many bushels did he take in each load ?

50. When 7 sheep cost 50 dollars, what does 1 sheep cost ?

51. If 1 man can set the type of a book in 45 days, in how many days can 5 men do the same work ? In how many days can 4 men do the same work ?

52. If a quantity of provision will last 32 persons 1 month, how many persons would the same provision last 8 months ?

53. If 45 dollars prize-money be shared equally by 9 men, how much does 1 man get ?

54. A merchant sold 10 yards of cloth for 75 cents, what was the price per yard ?

55. If you have forty peaches, and give 1 eighth to Annie, 1 fifth to John, and 1 fourth to Florence, how many do you give to each ? How many do you give to all ? How many do you have left ?

56. Having 60 pages of history to read, if I read 1 fourth of it on Monday, 1 fifth on Tuesday, and 1 sixth on Wednesday, how many pages do I read in all ? How many pages remain to be read ?

57. What is 1 half of 20, plus 1 eighth of 72 ?
58. What is 1 half of 60, plus 1 fifth of 60 ?
59. What is 1 fourth of 28, plus 1 third of 45 ?
60. What is 1 seventh of 56, less 1 ninth of 63 ?
61. What is 1 eighth of 72, less 1 sixth of 42 ?

SECTION XXI.

FINDING PARTS OF WHOLES, AND WHOLES FROM PARTS.

48. 1. If 3 boxes of blueberries cost 30 cents, what will 2 boxes cost ?

2. If 4 pounds of raisins cost 36 cents, what will 3 pounds cost ?

3. When 5 hats cost 60 cents, what will 4 hats cost ?

4. If a horse can travel 48 miles in 6 hours, how far can he travel in 5 hours ?

5. When 7 oranges are worth 42 apples, how many apples is 1 orange worth ?   How many apples are 5 oranges worth ?

6. If a peck of plums is worth 88 cents, how much is 1 quart worth ?   How much are 5 quarts worth ?

7. A man hired a laborer for 9 weeks, paying him 81 dollars.   What did he pay for 4 weeks' work ?

8. If 84 panes of glass are required for 7 windows, how many panes are required for 10 windows ?

9. If there are 72 windows in 6 cottages, how many windows are there in 9 similar cottages ?

10. What will 7 pairs of socks cost, at the rate of 3 pairs for 36 cents ?

11. A farmer exchanged 7 pigs for fowls, at the rate of 2 pigs for 18 fowls.   How many fowls did he receive ?

12. At the rate of 3 melons for 24 peaches, how many peaches can be bought for 7 melons ? for 9 melons ?

13. When a squash weighing 8 pounds can be bought for 32 cents, what should I pay for a squash weighing 19 pounds ?

14. If a cistern can be emptied by 2 pipes in 15 minutes, in how many minutes could it be emptied by 3 pipes of the same size ?

15. How many days would it take 7 men to earn as much as 5 men can earn in 6 days ?

16. A piece of work can be done by 10 men in 6 days. How many men could do the same work in 4 days ?

17. When 3 dollars will buy 33 yards of gingham, how much will 6 dollars buy ?

18. What is 1 third of 36 ? 2 thirds of 36 ?

19. What is 1 fourth of 32 ? 3 fourths of 32 ?

20. What is 1 fifth of 55 ? 4 fifths of 55 ?

21. What is 1 sixth of 42 ? 5 sixths of 42 ?

22. What is 1 seventh of 84 ? 6 sevenths of 84 ?

23. What is 1 eighth of 72 ? 5 eighths of 72 ?

24. Add 1 fourth of 44 to 3 fifths of 35.

25. Add 2 sevenths of 28 to 9 tenths of 30.

26. Add 5 twelfths of 48 to 3 sevenths of 49.

27. Add 3 eighths of 40 to 2 ninths of 54.

28. James gave away 8 figs, which was 1 half of the number he had.   How many figs had he ?

29. Ada missed 10 words of her spelling lesson, which was 1 third of the words given out.   How many words were given out ?

30. I have read 9 pages of a report, which is 1 fourth of the entire report.   How long is the report ?

31. John, who is 7 years old, is 1 fifth as old as his father. How old is his father ?

32. My woodland, which contains 6 acres, is 1 sixth of my farm.   How many acres does my farm contain ?

33. Clarence has weeded 5 rows of onions, which is 1 eighth of his stint.   How much is his stint ?

34. A farmer sold 12 bushels of apples, which was 1 eighth of all he raised.   How many bushels did he raise ?

35. Homer lives 8 rods from school, which is 1 ninth as far as Dora lives.   How far from school does Dora live ?

36. 11 is 1 fourth of what number ? 9 is 1 fifth of what ?

37. 8 is 1 sixth of what number ? 9 is 1 seventh of what ?

38. 12 is 1 eighth of what number ? 6 is 1 ninth of what ?

39. 11 is 1 tenth of what number ? 12 is 1 eleventh of what ?

40. Blanche spent 24 cents, which was 2 thirds of the money she had. How many cents had she ? [See page 169.]

41. I found, after riding 27 miles, that I had gone 3 fourths of the length of my journey. How long was my journey ?

42. Alice has spent 10 weeks at school, which is 2 sevenths of the time she attends in a year. How many weeks does she attend in a year ?

43. If, during the winter, I have used 8 tons of coal in my house, and this is 2 ninths of what I have used in my factory, how many tons have I used in my factory ?

44. Mr. Jones spends 12 dollars a week for board, which is 4 tenths of what he earns. How much does he earn ?

45. Horace paid 18 dollars for 3 eighths of a boat. What was the price of the boat ?

46. Having gone 3 fifths of my journey, 8 miles remain. How many fifths of the journey remain ? How many miles is the whole journey ?

47. After spending 4 sevenths of my money, I have 33 cents left. How much money had I at first ?

48. An auctioneer who keeps 1 tenth of the amount of his sales returns 54 dollars to a person for whom he has sold goods. What was the amount of the sale ?

49. 22 is 2 thirds of what number ?

50. 24 is 3 fourths of what number ?

51. 36 is 4 fifths of what number ?

52. 35 is 5 sixths of what number ?

53. 36 is 4 sevenths of what number ?

54. 33 is 3 eighths of what number ?

55. 56 is 8 ninths of what number ?

56. 21 is 3 elevenths of what number ?

SECTION XXII.

MISCELLANEOUS EXAMPLES.

49. 1. At $ 8 (8 dollars) a gallon, how much are 5 gallons and a pint of sperm-oil worth ?

2. If 2 cents will buy 12 marbles, how many marbles will 12 cents buy ?

3. What is the cost of 6 buttons, at the rate of 10 for $1 ?

4. How much shall I pay for 4 hours' washing, at 15 cents an hour, and 2 hours' ironing at 17 cents an hour ?

5. What is the cost of laundry work on 1 sack at 25 cents, and 7 pieces at the rate of 96 cents a dozen ?

6. Add together 12 and 13 and the difference of 18 and 15.

7. What number added to the sum of 12 and 29 will make 50 ?

8. A railroad ticket allowing 100 rides having been used 31 times, how many more times can it be used ?

9. If $1 will buy 6 dozen eggs, how many eggs will a dollar and a half buy ?

10. At $2 a dozen, how many handkerchiefs can be bought for $5 ?

11. How many pounds of butter, at 12 cents a pound, must be given for 8 yards of muslin, at 9 cents a yard ?

12. Marvin and Fanny made a collection of beetles. Marvin collected 28 kinds, and Fanny collected 42 kinds. How many more kinds did Fanny collect than Marvin ? Of Fanny's beetles, 16 kinds were like some of Marvin's. How many different kinds did both find ?

13. A river is 132 feet wide, and a man has just started to row across in a boat 12 feet long, and headed from the bank. How many lengths of the boat must he row that the boat may touch the opposite bank ?

5

14. Mr. Cate paid $12 a week for his board, which was 2 fifths of what he earned. How much did he earn?

15. Gilbert and Charles start from the same place and walk, one east 20 yards, the other north 15 yards. They then walk towards each other till they meet, Gilbert walking 16 yards and Charles 9. How many yards did both walk, and how many more did John walk than Charles?

16. Two persons were 18 miles apart, and walking towards each other, one at the rate of 4 miles an hour and the other at the rate of 3 miles an hour. How far apart were they at the end of 2 hours?

17. A physician made 10 visits on Monday, 3 on Tuesday, 5 on Wednesday, 8 on Thursday, 7 on Friday, 9 on Saturday, and 2 on Sunday. How many visits did he make during the week?

18. For 18 of the visits he charged $2 a visit; for 15 he charged $3 a visit; and for the rest, nothing. What was the amount of his bills? How many visits did he make without charge?

19. There is a pond 22 rods wide. How many rods does a person skate who skates across the pond and back and half-way across again?

20. Two men had 18 cows apiece; while the first sold a third of his, the second bought half as many more as he had at first. How many had each man then?

21. Amy had 28 cents, with which she bought a Christmas card for 6 cents, and as many more as she could at the rate of 2 for 5 cents. How many cards did she buy, and how many cents had she left?

22. A teacher wished to buy 48 cards for her pupils. She could get 4 cards for 5 cents or 5 better cards for 10 cents. How much must she pay for 28 of the first kind and enough of the second kind to make up the required number?

23. When a dozen photographs can be bought for 84 cents, what is the cost of one dozen and two?

SECTION XXIII.

FRACTIONS.

A unit.   Halves.   Thirds.   Fourths.   Fifths.   Sixths.

NOTE. — The questions in this section are to be worked, for the most part, by direct use of the illustrations ; or, better still, if the teacher have them, by the use of blocks shaped like the illustrations.

50. 1. When a thing is divided into two equal parts, what is one of the parts called ?

2. What is one of the parts called when a thing is divided into three equal parts ? into four equal parts ? into five ? into six ?

3. What is one of the parts called when a thing is divided into seven equal parts ? into eight equal parts ? into ten ? into twelve ?

Any whole thing is a *unit.* One or more of the equal -parts of a thing is a *fraction.*

NOTE. — One of the equal parts of a thing is a *fractional* unit, and any number of such parts is a *fractional number.* But the word fraction as commonly used means either a fractional unit or a fractional number.

4. Mr. Stone cut a cheese into five equal parts and sold two of them. What fraction of the cheese did he sell ? What fraction did he keep ? Did he keep more than he sold, or less ?

5. Which is the larger fraction, two fifths or three fifths ? one third or one fifth ? two thirds or one half ? three fourths or four fifths ? one half, two fourths, or three sixths ?

6. In a whole thing, or a unit, are how many halves ? how many thirds ? fourths ? tenths ? twelfths ?

7. If you had two apples, how many halves of an apple could you make of them ? how many quarters ?

8. In two units are how many halves ? how many thirds ? fourths ? sixths ?|

9. How many halves are there in three units ? in four ?

10. How many thirds are there in two units ? in five ?

11. How many fifths are there in four units ? in ten ?

12. How many sixths are there in six units ? in eight ?

51.   13. Here are how many halves ? How many whole things, or units, can you make of them ?

14. How many units in six halves ? in eight halves ? in twenty halves ?

15. Here are how many thirds ? How many units can you make of them ?

16. How many units in nine thirds ? in twelve thirds ? in twenty-seven thirds ?

17. How many units in twelve fourths ? in twenty fourths ? in forty-two sixths ? in eighty tenths ?

18. There were six children, and each had two thirds of a cake. How many cakes had been divided among them ?

19. John can earn three fifths of a dollar in a day. How many dollars can he earn in ten days ?

20. Henry bought thirty-two pounds of meat at a quarter of a dollar a pound. How many dollars did it come to ?

52.   21. One half of a pie was cut into two equal pieces. What part of a whole pie was one of the pieces ?

22. One half of one half of a thing is what part of it ?

23. Two fourths of a thing is equal to what part of it ?

24. One half of a thing is equal to how many sixths?

25. If one half of an apple be divided into three equal parts, one of these parts is what part of the whole apple?

26. One third of one half of a thing is what part of it?

27. One third of a thing is equal to how many sixths?

28. If one third of a melon be divided into two equal parts, one of these parts is what part of the melon?

29. What is one half of one third of a thing?

30. Is there any difference between one half of one third of a thing and one third of one half of it?

31. One foot is one third of a yard. What part of a yard is half a foot?

32. Mary's class in arithmetic usually recites half an hour, but to-day the lesson was finished in one third of that time. What part of an hour did the lesson take to-day?

33. Two feet are how many thirds of a yard? how many sixths?

34. What is the difference between one third and one half of a thing?

35. What is the difference between two thirds and one half of a thing?

53. 36. How many eighths make a whole thing?

37. If each half of a thing be divided into four equal parts, into how many parts will the thing be divided? What part of a whole thing is one fourth of a half?

38. If each fourth of a thing be divided into two equal parts, into how many parts will the thing be divided? What part of the whole thing is one half of a fourth?

Eighths.

39. Which is the larger, one fourth of one half, or one half of one fourth of a thing?

40. One half of a thing equals how many eighths of it ?

41. Three fourths of one half of a thing is how many eighths of it ?

42. One half of three fourths of a thing is how many eighths of it ? ·

43. If one yard of gingham costs half a dollar, how much does one quarter of a yard cost ?

44. Fred has some brads three quarters of an inch long, and some others just half as long. How long are the latter ?

54.   45. If each fifth of a thing be divided into two equal parts, into how many equal parts will the thing be divided ? What part of a thing is one half of a fifth of it ?

Tenths.   46. In one fifth are how many tenths ?

47. How many tenths are there in two fifths ? in three fifths ? in four fifths ?

48. Mary has a mile to walk to school. How many tenths of a mile has she to go after she has walked three tenths ? five tenths ? nine tenths ?

49. When Mary has walked six tenths of a mile, how many fifths of a mile has she walked ?

50. Which is the more money, six tenths of a dollar or four fifths of a dollar ? How much more ?

51. Abbot spent three tenths of a dollar for a slate, six tenths for a book, and seven tenths for a cap. How many dollars did he spend ?

55.   52. How many twelfths make a whole thing ?

53. How much of a whole thing remains when one twelfth of it has been taken out ? when two twelfths have been taken ? when three twelfths have been taken ?

Twelfths.   have been taken ?

54. If each half of a thing be divided into six equal parts, into how many parts will the thing be divided ? What part of a thing is one sixth of one half of it ?

55. Six twelfths of a thing is what part of it ?

56. If each third of a thing be divided into four equal parts, one of these parts is what part of the whole thing ?

57. How many twelfths are there in one third ? in two thirds ?

58. Four twelfths of a thing are how many thirds ?

59. Eight twelfths of a thing are how many thirds ?

60. When three twelfths of a thing have been taken out, how many twelfths remain ? How many fourths ?

61. When nine twelfths of a thing have been taken out, how many fourths remain ?

62. If one sixth of a thing be divided into two equal parts, one of these parts is what part of the whole thing ?

63. Compare one sixth of one half with one half of one sixth. What do you find to be true ?

64. In five sixths of a thing are how many twelfths ?

65. Ten twelfths of a thing are how many sixths of it ?

66. How many twelfths are there in one third of a thing ? in one fourth of it ?

67. How many twelfths in one third and one fourth added together ?

68. How many twelfths in one fourth and one sixth added together ?

69. What is the difference between one third and one fourth ?

70. What is the difference between one fourth and one sixth ?

71. What is the difference between three fourths and two thirds ?

72. What is the difference between two thirds and one fourth ?

SECTION XXIV.

THE WRITING OF FRACTIONS.

56. Fractions are written with figures, thus :

One half	. . . . .	$\frac{1}{2}$	Seven thirds	$\frac{7}{3}$
One third	$\frac{1}{3}$	Seventeen thirty-seconds .	$\frac{17}{32}$
Two thirds	$\frac{2}{3}$	Nineteen twenty-firsts. .	$\frac{19}{21}$
Three fifths	$\frac{3}{5}$	Two and seven eighths .	$2\frac{7}{8}$
Eight tenths	$\frac{8}{10}$	Six and four fiftieths . .	$6\frac{4}{50}$
Ten twelfths	$\frac{10}{12}$	Fifteen and twenty-five	
Ten halves	$\frac{10}{2}$	hundredths . . .	$15\frac{25}{100}$

The number written above the line is the **numerator** (numberer). It tells how many equal parts are taken. The number written below the line is the **denominator** (namer). It tells into how many equal parts the unit is divided. The numerator and denominator are called the **terms** of the fraction. A number like $2\frac{7}{8}$ or $15\frac{25}{100}$, which is partly a whole number and partly a fraction, is called a **mixed number.**

1. What fraction does this picture represent? What is the numerator ? Why ? What is the denominator ? Why ? Write the fraction.

2. What fraction does this picture represent ? What is the numerator ? Why ? What is the denominator ? Why ? Write the fraction.

3. If a unit were divided into twelve equal parts, and seven of them were taken, what fraction would be taken ? What would be its numerator ? Why ? What would be its denominator ? Why ? Write the fraction.

Draw pictures on the slate or blackboard to represent the following :

$\frac{1}{2}$, $\frac{1}{4}$, $\frac{2}{3}$, $\frac{1}{5}$, $\frac{2}{5}$, $\frac{3}{5}$, $\frac{4}{5}$, $\frac{5}{6}$, $\frac{1}{8}$, $\frac{3}{8}$, $\frac{5}{8}$, $\frac{7}{8}$.

To change Whole or Mixed Numbers to Fractional Numbers.

57. 4. Change 4 to halves; 3 to fifths; 7 to ninths.

5. Change 5 to thirds; 8 to sevenths; 9 to sixths.

6. What mixed number does this picture represent ?

7. How many halves are represented in this picture ? In $2\frac{1}{2}$ are how many halves ?

8. What mixed number does this picture represent ?

9. How many thirds are represented in this picture ? In $2\frac{1}{3}$ are how many thirds ?

Draw pictures on the slate or blackboard to represent the following :

$1\frac{1}{2} = \frac{3}{2}$, $1\frac{2}{3} = \frac{5}{3}$, $2\frac{1}{4} = \frac{9}{4}$, $2\frac{3}{4} = \frac{11}{4}$, $2\frac{3}{8} = \frac{19}{8}$.

10. How many halves in $3\frac{1}{2}$? (See page 169.)

11. How many thirds in $2\frac{1}{3}$? in $3\frac{2}{3}$? in $5\frac{2}{3}$?

12. How many fifths in $4\frac{1}{5}$? in $2\frac{3}{5}$? in $9\frac{2}{5}$?

13. Change $4\frac{3}{7}$ to sevenths ; $5\frac{3}{8}$ to eighths ; $7\frac{1}{12}$ to twelfths.

14. Change $4\frac{3}{10}$ to tenths ; $2\frac{5}{6}$ to sixths ; $3\frac{5}{16}$ to sixteenths.

15. Reduce, or change, $3\frac{4}{9}$ to a fractional number.

NOTE. — Change to ninths.

16. Reduce $3\frac{4}{7}$, $6\frac{5}{7}$, $8\frac{3}{7}$, $12\frac{5}{7}$, to fractional numbers.

17. How many quarters of a dollar in $3\frac{3}{4}$ dollars ?

18. In $2\frac{5}{8}$ inches, how many eighths of an inch?

19. In $3\frac{3}{10}$ miles, how many tenths of a mile?

20. How many sixths of an hour in $4\frac{2}{3}$ hours?

21. John earned $\$6\frac{3}{5}$ in 4 days. How many fifths of a dollar did he earn in 4 days? How many fifths of a dollar in one day?

To change Fractional Numbers to Whole or Mixed Numbers.

58. 22. How many ones, or units, in $\frac{6}{3}$? (See page 169.)

23. How many ones in $\frac{4}{3}$? in $\frac{10}{4}$? in $\frac{7}{4}$? in $\frac{12}{4}$?

24. How many ones in $\frac{21}{8}$? in $\frac{35}{6}$? in $\frac{28}{8}$? in $\frac{16}{3}$?

25. How many ones in $\frac{33}{9}$? in $\frac{39}{9}$? in $\frac{37}{16}$? in $\frac{47}{9}$?

26. How many ones in $\frac{54}{9}$? in $\frac{44}{8}$? in $\frac{54}{4}$? in $\frac{65}{9}$?

27. Change $\frac{43}{5}$ to a mixed number. (See page 00.)

28. Change $\frac{17}{5}$, $\frac{29}{9}$, $\frac{60}{8}$, $\frac{78}{8}$, to mixed numbers.

29. Reduce $\frac{99}{7}$, $\frac{75}{9}$, $\frac{102}{8}$, $\frac{115}{11}$, to mixed numbers.

30. At $\$\frac{1}{2}$ a bushel, how many dollars must be paid for 15 bushels of potatoes?

31. If a teacher gives $\frac{1}{4}$ of an hour to each class, how long will it take to hear 9 classes recite?

Changing the Terms of Fractions.

$\frac{1}{2}$ $\frac{2}{4}$ $\frac{3}{8}$ $\frac{4}{8}$ $\frac{5}{10}$ $\frac{6}{12}$ $\frac{8}{16}$
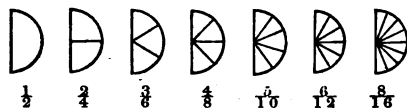
32. In $\frac{1}{2}$ are how many fourths? how many sixths? eighths? tenths? twelfths? sixteenths? twentieths? twenty-fourths? fiftieths? hundredths?

33. What is the numerator of each of the following?

$$\frac{1}{2} = \frac{}{4} = \frac{}{6} = \frac{}{8} = \frac{}{10} = \frac{}{12} = \frac{}{20} = \frac{}{24} = \frac{}{18} = \frac{}{14}.$$

34. By what number must you multiply both numerator and denominator to change $\frac{1}{2}$ to $\frac{2}{4}$? to change $\frac{1}{2}$ to $\frac{4}{8}$? to change $\frac{1}{2}$ to $\frac{7}{14}$? to change $\frac{4}{8}$ to $\frac{12}{24}$?

35. Have all these fractions the same value? What is that value?

36. In $\frac{1}{3}$ are how many sixths? how many twelfths?

37. By what number must you multiply both numerator and denominator to change $\frac{1}{3}$ to $\frac{2}{6}$? to change $\frac{1}{3}$ to $\frac{3}{9}$? to change $\frac{1}{3}$ to $\frac{4}{12}$? to change $\frac{1}{3}$ to $\frac{6}{18}$? to change $\frac{2}{6}$ to $\frac{4}{12}$? to change $\frac{3}{9}$ to $\frac{6}{18}$?

38. Have all these fractions the same value? What is that value?

39. What is the numerator of each of the following?

$$\frac{1}{3} = \frac{}{6} = \frac{}{9} = \frac{}{12} = \frac{}{18} = \frac{}{15} = \frac{}{21} = \frac{}{27} = \frac{}{24}.$$

40. In $\frac{1}{4}$ are how many eighths? how many twelfths? sixteenths? twentieths? twenty-fourths?

41. By what must you multiply both numerator and denominator to change $\frac{1}{4}$ to $\frac{2}{8}$? to change $\frac{1}{4}$ to $\frac{3}{12}$? to change $\frac{1}{4}$ to $\frac{4}{16}$? to change $\frac{1}{4}$ to $\frac{6}{24}$? to change $\frac{2}{8}$ to $\frac{4}{16}$? to change $\frac{3}{12}$ to $\frac{6}{24}$?

42. Have all these fractions the same value? What is that value?

43. What is the numerator of each of the following?

$$\frac{1}{4} = \frac{}{8} = \frac{}{12} = \frac{}{20} = \frac{}{16} = \frac{}{24} = \frac{}{32} = \frac{}{28} = \frac{}{40} = \frac{}{36} = \frac{}{24}.$$

44. In $\frac{3}{4}$ how many eighths? twelfths? sixteenths? twentieths? thirty-sixths? forty-fourths?

45. What is the numerator of each of the following?

$$\tfrac{3}{4} = \tfrac{}{8} = \tfrac{}{12} = \tfrac{}{16} = \tfrac{}{20} = \tfrac{}{24} = \tfrac{}{32} = \tfrac{}{40} = \tfrac{}{48}.$$

46. By what number must you multiply both numerator and denominator to change $\tfrac{3}{4}$ to $\tfrac{6}{8}$? $\tfrac{3}{4}$ to $\tfrac{9}{12}$? $\tfrac{3}{4}$ to $\tfrac{12}{16}$? $\tfrac{3}{4}$ to $\tfrac{15}{20}$? to change $\tfrac{6}{8}$ to $\tfrac{18}{24}$? $\tfrac{6}{8}$ to $\tfrac{30}{40}$? $\tfrac{9}{12}$ to $\tfrac{27}{36}$? $\tfrac{9}{12}$ to $\tfrac{36}{48}$?

47. Have all these fractions the same value? What is that value?

Draw pictures to show that $\tfrac{3}{5} = \tfrac{6}{10}$; that $\tfrac{2}{3} = \tfrac{8}{12}$; that $\tfrac{3}{5} = \tfrac{6}{10}$; that $\tfrac{3}{5} = \tfrac{6}{10}$.

How is the *value* of a fraction affected, if both numerator and denominator are multiplied by the same number?

Ans. If both numerator and denominator of a fraction be multiplied by the same number, the value of the fraction will not be changed.

48. Change $\tfrac{1}{2}$ to fourths.   (See page 169.)
49. How many sixths in $\tfrac{1}{2}$? in $\tfrac{1}{3}$? in $\tfrac{5}{6}$? in $\tfrac{2}{3}$?
50. How many eighths in $\tfrac{1}{2}$? in $\tfrac{1}{4}$? in $\tfrac{3}{4}$? in $\tfrac{7}{8}$?
51. How many tenths in $\tfrac{1}{2}$? in $\tfrac{2}{5}$? in $\tfrac{4}{5}$? in $\tfrac{3}{5}$?
52. How many twelfths in $\tfrac{1}{4}$? in $\tfrac{5}{6}$? in $\tfrac{2}{3}$? in $\tfrac{3}{4}$?
53. How many sixteenths in $\tfrac{3}{8}$? in $\tfrac{3}{4}$? in $\tfrac{5}{8}$? in $\tfrac{11}{4}$?
54. How many twentieths in $\tfrac{1}{2}$? in $\tfrac{3}{4}$? in $\tfrac{4}{5}$? in $1\tfrac{3}{5}$?
55. How many thirty-sixths in $\tfrac{2}{3}$? in $\tfrac{5}{6}$? in $\tfrac{7}{12}$? in $\tfrac{3}{4}$?
56. How many fortieths in $\tfrac{1}{2}$? in $\tfrac{5}{8}$? in $\tfrac{4}{5}$? in $1\tfrac{1}{4}$?
57. How many sixtieths in $\tfrac{1}{2}$? in $\tfrac{2}{3}$? in $\tfrac{3}{4}$? in $\tfrac{7}{12}$?
58. Change $\tfrac{1}{2}$, $\tfrac{4}{7}$, $\tfrac{3}{3}$, to fourteenths.
59. Change $\tfrac{3}{4}$, $\tfrac{5}{8}$, $\tfrac{7}{8}$, and $\tfrac{5}{12}$ to twenty-fourths.
60. Change $\tfrac{2}{5}$, $\tfrac{3}{10}$, $\tfrac{5}{8}$, and $\tfrac{2}{3}$ to thirtieths.

How is the value of a fraction affected, if both numerator and denominator be divided by the same number?

Ans. If both numerator and denominator be divided by the same number, the value of the fraction will not be changed.

By what must you divide both numerator and denominator

61. To change $\frac{2}{4}$ to $\frac{1}{2}$? $\frac{4}{8}$ to $\frac{1}{2}$? $\frac{2}{6}$ to $\frac{1}{3}$? $\frac{6}{8}$ to $\frac{3}{4}$?

62. To change $\frac{9}{12}$ to $\frac{3}{4}$? $\frac{8}{12}$ to $\frac{2}{3}$? $\frac{9}{12}$ to $\frac{3}{4}$? $\frac{16}{20}$ to $\frac{4}{5}$?

63. To change $\frac{12}{18}$ to $\frac{2}{3}$? $\frac{15}{20}$ to $\frac{3}{4}$? $\frac{25}{30}$ to $\frac{5}{6}$? $\frac{36}{40}$ to $\frac{9}{10}$?

When both numerator and denominator are divided by the same number, the fraction is changed to smaller terms. When no number can be found which will divide both numerator and denominator without a remainder, the fraction is in its *smallest terms*.

64. Change $\frac{2}{4}$, $\frac{4}{8}$, $\frac{6}{10}$, $\frac{5}{8}$, and $\frac{8}{12}$ to their smallest terms.

65. Change $\frac{9}{12}$, $\frac{9}{14}$, $\frac{10}{18}$, $\frac{12}{18}$, and $\frac{12}{14}$ to their smallest terms.

66. Change $\frac{12}{24}$, $\frac{9}{24}$, $\frac{18}{24}$, $\frac{9}{24}$, and $\frac{20}{24}$ to their smallest terms.

67. Change $\frac{14}{28}$, $\frac{9}{32}$, $\frac{24}{32}$, $\frac{31}{32}$, and $\frac{24}{36}$ to their smallest terms.

68. Change $\frac{30}{40}$, $\frac{12}{48}$, $\frac{30}{80}$, $\frac{14}{56}$, and $\frac{18}{63}$ to their smallest terms.

Common Denominator.

59. When $\frac{2}{3}$ is changed to $\frac{4}{6}$, the *value* of the fraction is not changed, but the *name* of the fraction is changed. The denominator is 6 instead of 3, showing that the unit is divided into 6 equal parts instead of 3 equal parts. The parts are therefore half as large; but the numerator is 4 instead of 2, showing that twice as many parts are taken. When $\frac{3}{4}$ is changed to $\frac{9}{12}$, the parts of the unit are one third as large as before, but three times as many of them are taken. We multiply the denominator to change the name of the fraction, but we must multiply the numerator likewise, to keep the value of the fraction unchanged.

69. What changes of name may be made in any number of halves? *Ans.* Halves may be changed to fourths, sixths, eighths, tenths, twelfths, etc.

70. What changes of name may be made in any number of thirds?

71. Fourths may be changed to what?

72. Fifths may be changed to what?

73. Sevenths may be changed to what?

74. Tenths may be changed to what?

75. Are the two fractions $\frac{1}{3}$ and $\frac{1}{4}$ alike or different in their names? Change $\frac{1}{3}$ and $\frac{1}{4}$ each to twelfths. How do the fractions $\frac{4}{12}$ and $\frac{3}{12}$ compare in their names?

When two or more fractions are changed to the same name, the new denominator is called a ***common denominator.***

76. Change $\frac{1}{2}$ and $\frac{1}{3}$ to fractions having a common denomi-nator.   *Ans.* $\frac{1}{2}$ equals $\frac{3}{6}$, and $\frac{1}{3}$ equals $\frac{2}{6}$.

To change $\frac{1}{2}$ and $\frac{1}{3}$ to fractions having a common denominator we may take for the new denominator 6, 12, 18, or any number which is a multiple of the denominators 2 and 3. It is best to take as small a number as we can, so we take 6, and have for the answer, $\frac{1}{2}$ equals $\frac{3}{6}$, and $\frac{1}{3}$ equals $\frac{2}{6}$.

Change the following to fractions having a common denomi-nator:

77. $\frac{1}{2}$ and $\frac{2}{3}$.	84. $\frac{2}{3}$ and $\frac{3}{4}$.	91. $\frac{1}{4}$ and $\frac{5}{12}$.	98. $\frac{2}{3}$ and $\frac{7}{12}$.
78. $\frac{1}{2}$ and $\frac{3}{4}$.	85. $\frac{2}{3}$ and $\frac{3}{5}$.	92. $\frac{2}{3}$ and $\frac{4}{5}$.	99. $\frac{5}{6}$ and $\frac{2}{3}$.
79. $\frac{1}{2}$ and $\frac{5}{6}$.	86. $\frac{1}{3}$ and $\frac{2}{7}$.	93. $\frac{1}{4}$ and $\frac{1}{6}$.	100. $\frac{5}{6}$ and $\frac{1}{12}$.
80. $\frac{1}{2}$ and $\frac{2}{3}$.	87. $\frac{1}{3}$ and $\frac{1}{5}$.	94. $\frac{1}{4}$ and $\frac{3}{8}$.	101. $\frac{5}{6}$ and $\frac{7}{10}$.
81. $\frac{1}{2}$ and $\frac{7}{10}$.	88. $\frac{1}{3}$ and $\frac{7}{10}$.	95. $\frac{3}{4}$ and $\frac{5}{12}$.	102. $\frac{1}{4}$ and $\frac{2}{7}$.
82. $\frac{5}{8}$ and $\frac{1}{2}$.	89. $\frac{2}{3}$ and $\frac{5}{12}$.	96. $\frac{1}{3}$ and $\frac{1}{4}$.	103. $\frac{3}{4}$ and $\frac{5}{12}$.
83. $\frac{2}{3}$ and $\frac{1}{4}$.	90. $\frac{1}{3}$ and $\frac{4}{5}$.	97. $\frac{3}{4}$ and $\frac{1}{6}$.	104. $\frac{1}{6}$ and $\frac{2}{5}$.

105. $\frac{1}{2}$, $\frac{1}{3}$, and $\frac{1}{6}$.   107. $\frac{3}{4}$, $\frac{5}{6}$, $\frac{1}{6}$, and $\frac{7}{12}$.
106. $\frac{1}{5}$, $\frac{5}{8}$, and $\frac{3}{4}$.   108. $\frac{3}{4}$, $\frac{5}{8}$, $\frac{5}{8}$, $\frac{2}{3}$, and $\frac{7}{12}$.

109. A man left by his will $\frac{1}{3}$ of his estate to his church, $\frac{1}{4}$ to the town library, and $\frac{5}{12}$ to a school. What fractions hav-ing a common denominator will express these several parts?

110. If A can do a piece of work in 4 days, B in 5 days, and C in 10 days, what part of the work can A do in 1 day? What part can B do in 1 day? What part can C do in 1 day? What fractions having a common denominator will express the above parts?

SECTION XXV.

ADDITION AND SUBTRACTION OF FRACTIONS.

Addition.

60. 1. What is the sum of $\frac{2}{3}$ and $\frac{1}{4}$?

To add $\frac{2}{3}$ and $\frac{1}{4}$, both fractions must be changed to fractions having a common denominator. [See page 78.] *Ans.* $\frac{11}{12}$.

2. What is the sum of $\frac{1}{2}$ and $\frac{2}{3}$? *Ans.* $\frac{7}{6}$, or $1\frac{1}{6}$.
3. What is the sum of $\frac{1}{4}$ and $\frac{4}{5}$? *Ans.* $\frac{21}{20}$, or $1\frac{1}{20}$.
4. What is the sum of $3\frac{2}{3}$ and $4\frac{1}{4}$? *Ans.* $7\frac{11}{12}$.

What is the sum

5. Of $\frac{1}{3}$ and $\frac{1}{3}$?	15. Of $\frac{2}{3}$ and $\frac{1}{4}$?	25. Of $\frac{3}{4}$ and $\frac{1}{5}$?
6. Of $\frac{1}{2}$ and $\frac{2}{3}$?	16. Of $\frac{2}{3}$ and $\frac{4}{5}$?	26. Of $\frac{3}{4}$ and $\frac{5}{6}$?
7. Of $\frac{2}{3}$ and $\frac{1}{4}$?	17. Of $\frac{2}{3}$ and $\frac{1}{7}$?	27. Of $\frac{1}{4}$ and $\frac{3}{7}$?
8. Of $\frac{1}{3}$ and $\frac{5}{6}$?	18. Of $\frac{2}{3}$ and $\frac{11}{12}$?	28. Of $\frac{1}{4}$ and $\frac{5}{8}$?
9. Of $\frac{1}{3}$ and $\frac{1}{2}$?	19. Of $\frac{2}{3}$ and $\frac{7}{8}$?	29. Of $\frac{3}{4}$ and $\frac{11}{12}$?
10. Of $\frac{1}{2}$ and $\frac{3}{8}$?	20. Of $\frac{1}{3}$ and $\frac{7}{10}$?	30. Of $\frac{1}{4}$ and $\frac{7}{16}$?
11. Of $\frac{1}{2}$ and $\frac{7}{10}$?	21. Of $\frac{1}{3}$ and $\frac{1}{12}$?	31. Of $\frac{3}{4}$ and $\frac{17}{12}$?
12. Of $\frac{2}{3}$ and $\frac{7}{12}$?	22. Of $\frac{2}{3}$ and $\frac{7}{20}$?	32. Of $\frac{2}{3}$ and $\frac{1}{2}$?
13. Of $\frac{1}{2}$ and $\frac{1}{11}$?	23. Of $1\frac{2}{3}$ and $\frac{4}{11}$?	33. Of $\frac{2}{3}$ and $\frac{5}{8}$?
14. Of $\frac{1}{2}$ and $\frac{7}{15}$?	24. Of $9\frac{1}{3}$ and $\frac{8}{9}$?	34. Of $\frac{4}{5}$ and $\frac{7}{12}$?

35. Find $6\frac{5}{6} + 1\frac{3}{8}$.	37. Find $2\frac{4}{5} + \frac{7}{15}$.	39. Find $3\frac{7}{8} + 3\frac{1}{12}$.
36. Find $3\frac{1}{2} + 4\frac{1}{3}$.	38. Find $6\frac{5}{6} + 1\frac{5}{7}$.	40. Find $8\frac{3}{4} + 3\frac{2}{3}$.

Find the sum

41. Of $\frac{1}{3}$, $\frac{1}{4}$, and $\frac{1}{6}$.	44. Of $2\frac{1}{2}$, $3\frac{1}{4}$, and $5\frac{7}{8}$.
42. Of $\frac{1}{2}$, $\frac{5}{8}$, and $\frac{2}{3}$.	45. Of $5\frac{3}{4}$, $4\frac{1}{12}$, and $8\frac{3}{4}$.
43. Of $\frac{3}{10}$, $\frac{1}{4}$, and $\frac{2}{3}$.	46. Of $7\frac{2}{3}$, $5\frac{1}{10}$, and $7\frac{5}{12}$.

47. After burning $\frac{5}{6}$ of a cord of wood, Mr. Shaw had $\frac{3}{4}$ of a cord left.   How much wood had he at first ?

48. From a street corner a walk was laid ½ of a mile in one direction, and ¼ of a mile in another. What length of walk was laid?

49. To make a box it required ⅔ of a pound of finishing nails, ½ of a pound of brads, and ⅙ of a pound of gimp tacks. What weight of all did it require?

50. How many yards of silk in three remnants, one containing 1⅓ yards, one 2⅝ yards, and the other ⅓ of a yard?

51. Mr. Wise bought cloth at $1¼ per yard; he sold it so as to gain $⅓ per yard. What did he receive per yard?

52. Out of a cask of kerosene, 12⅝ gallons were sold, 2¾ gallons leaked out, and 15¾ remained. How many gallons were in the cask at first?

53. What is the number out of which if ¾ be taken ⅝ will remain?

54. How many rods of fence will inclose a triangular lot whose three sides are respectively 8½, 5¾, and 4⅙ rods long?

Subtraction.

61. **55.** What will remain if ¼ be subtracted from ⅔?

To subtract ¼ from ⅔, both fractions must be changed to fractions having a common denominator.   *Ans.* $\frac{5}{12}$.

56. What will remain if ⅔ be taken out of ⅞?   *Ans.* $\frac{5}{20}$.

57. What will remain if ⅝ be taken out of 4⅔?   *Ans.* 3⅙.

58. From ½ take ⅓.	67. From 4⁄7 take ⅕.	76. From ⅘ take ⅔.
59. From ⅔ take ⅖.	68. From ⅝ take ⅛.	77. From ¾ take ½.
60. From ⅔ take ¼.	69. From ½ take ⅕.	78. From ⅔ take ⅖.
61. From ⅔ take ⅗.	70. From ⅔ take 7⁄10.	79. From 6⁄7 take ⅔.
62. From ⅝ take ⅓.	71. From ⅓ take 1⁄10.	80. From ¼ take ⅐.
63. From ¾ take ⅖.	72. From 4⁄5 take ⅔.	81. From ½ take 1⁄13.
64. From ⅝ take ⅓,	73. From ¼ take ⅕.	82. From 4⁄7 take ⅜.
65. From 7⁄9 take ⅐.	74. From ¾ take ⅖.	83. From ⅔ take ⅐.
66. From ⅝ take ⅘.	75. From 7⁄8 take ⅜.	84. From ⅜ take ⅔.

85. What is $1\frac{2}{3}$ less $\frac{1}{3}$? | 88. What is $4\frac{1}{4}$ less $1\frac{5}{6}$?
86. What is $2\frac{3}{4}$ less $\frac{3}{8}$? | 89. What is $3\frac{1}{4}$ less $1\frac{2}{3}$?
87. What is $3\frac{4}{9}$ less $\frac{5}{12}$? | 90. What is $4\frac{2}{3}$ less $2\frac{3}{4}$?

91. Find $3\frac{5}{8} - \frac{3}{4}$. | 94. Find $5\frac{1}{2} - 1\frac{2}{3}$. | 97. Find $6\frac{1}{2} - 2\frac{11}{14}$.
92. Find $2\frac{1}{4} - \frac{3}{8}$. | 95. Find $4\frac{3}{8} - 2\frac{2}{3}$. | 98. Find $8\frac{2}{5} - 6\frac{4}{9}$.
93. Find $2\frac{7}{8} - \frac{4}{5}$. | 96. Find $5\frac{1}{8} - 1\frac{3}{4}$. | 99. Find $7\frac{1}{2} - 5\frac{3}{8}$.

100. A whip-handle is $\frac{1}{2}$ of a yard long, and the whip-lash is $1\frac{3}{4}$ yards long. How much longer is the lash than the handle ?

101. To plough a garden took $2\frac{3}{4}$ hours; to plant it took $11\frac{1}{4}$ hours. How much less time did it take to plough than to plant the garden ?

102. From a log $20\frac{5}{8}$ feet long, $10\frac{7}{8}$ feet were sawed. What was the length of the remaining part ?

103. Some hop-poles $12\frac{3}{8}$ feet long were set $3\frac{5}{12}$ feet in the ground. How many feet were above ground ?

104. If a ditch is to be $15\frac{1}{4}$ rods long, and $6\frac{3}{10}$ rods remain to be dug, how much has already been dug ?

Addition and Subtraction.

62. 105. From a barrel containing $31\frac{1}{2}$ gallons there leaked $7\frac{7}{8}$ gallons. How much then remained ?

106. Two engines start from the same point, going in opposite directions, one at the rate of $15\frac{2}{3}$ miles an hour, the other at the rate of $20\frac{6}{11}$ miles. How far apart will they be at the end of one hour ?

107. If a man has $12\frac{1}{2}$ dollars left after paying $3\frac{1}{3}$ dollars to one man and $\frac{7}{10}$ of a dollar to another, how much had he at first ?

108. A peddler spent in one day $2\frac{1}{4}$ dollars for the use of a team, $\frac{4}{5}$ of a dollar for keeping it, and $1\frac{1}{2}$ dollars for other expenses. What was the amount of his expenses ?

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109. After ¼ of the pupils of a school have left, and ⅔ have been promoted, what part remains ?

110. A fruit-dealer found, at the close of a day, that he had on hand fruit which cost 2₁₀ dollars, and that he had received 5¼ dollars from his sales.   If 2½ dollars of his cash was profit, what was the cost of his fruit ?

111. How many pounds in four cheeses weighing, respectively, 25½, 31⅜, 33₁₇₈, and 41¾ pounds ?

112. If A lives 1¾ miles east of B, and a relative lives 5⅘ miles east of B, how far must A travel to visit this relative ?

113. In a gale the top of a tree was broken off 15⅜ feet from the ground.   If the part broken off measured 18¾ feet, what was the height of the tree before the gale ?

114. If you spend ⅓ of a day in sleep, ⅛ at your meals, ¼ in school, and ₁₂ in work, what part of your time have you left for play ?   How many hours ?

115. Mary is required to spend 2 hours in study every evening.   If she spends ½ hour in history, ⅖ of an hour in arithmetic, ⅔ of an hour in geography, and the rest in drawing, how much time does she spend in drawing ?

116. What number is that to which, if you add 6½, the sum will be 11⅚ ?

117. What number is that from which, if you take 4⅝, the remainder will be 7₁₁ ?

118. A student used ⅔ of a quire of paper on Monday, ⅓ of a quire on Tuesday, ¼ of a quire on Wednesday, ⅓ on Thursday, and ½ on Friday.   How much paper did he use ?   If he had 3 quires at first, how much paper had he left ?

119. A dealer in small wares paid 6 dollars for soap, 1⅘ dollars for combs, and 2½ dollars for other articles.   At the close of the day he found he had for his day's sales 7₁₀ dollars, and 5₁₀ dollars' worth of goods.   How much had he gained on the goods sold ?

SECTION XXVI.

MULTIPLICATION AND DIVISION OF FRACTIONS.

63. 1. How many are 4 times $\frac{3}{5}$?

Solution. Four times $\frac{3}{5}$ are $\frac{12}{5}$, which equals $2\frac{2}{5}$. *Ans.* 4 times $\frac{3}{5}$ are $2\frac{2}{5}$.

In multiplying $\frac{3}{5}$ by 4, by what operation is the result, $\frac{12}{5}$, obtained ?

How many are

(2.) 2 times $\frac{3}{5}$?

(3.) 7 times $\frac{3}{4}$?

(4.) 8 times $\frac{2}{3}$?

(5.) 6 times $\frac{4}{5}$?

(6.) 5 times $\frac{2}{3}$?

(7.) 3 times $\frac{6}{7}$?

(8.) 6 times $\frac{5}{11}$?

(9.) 4 times $\frac{7}{8}$?

(10.) 9 times $\frac{8}{10}$?

(11.) 7 times $1\frac{1}{2}$?

(12.) 9 times $8\frac{1}{2}$?

(13.) 5 times $7\frac{1}{8}$?

(14.) 8 times $7\frac{1}{4}$?

(15.) 4 times $12\frac{7}{8}$?

(16.) 10 times $11\frac{3}{8}$?

17. At $\$\frac{3}{4}$ a day, what are a boy's wages for 4 days ?

18. What cost 3 saws, at $\$1\frac{1}{2}$ each ?

19. How much ink will fill 7 bottles, each holding $\frac{7}{8}$ of a pint ?

20. How many bushels in 6 barrels of $3\frac{4}{5}$ bushels each ?

21. If 5 men can dig a trench in $4\frac{3}{4}$ days, in what time can 1 man dig it ?

64. 22. How many are 2 times $\frac{3}{8}$?

Solution. Two times $\frac{3}{8}$ are $\frac{6}{8}$, which equals $\frac{3}{4}$. *Ans.* $\frac{3}{4}$.

In the above example the result $\frac{3}{4}$ could be obtained at once by dividing the denominator of the fraction $\frac{3}{8}$ by 2. We thus find that

A fraction can be multiplied by multiplying the numerator, or by dividing the denominator.

The pupil may show the reason for this by showing the effect of multiplying the numerator, and the effect of dividing the denominator.

How many are

(23.) 4 times $\frac{3}{8}$?	(28.) 4 times $\frac{7}{12}$?	(33.) 9 times $\frac{5}{18}$?
(24.) 2 times $\frac{5}{6}$?	(29.) 7 times $\frac{3}{14}$?	(34.) 8 times $1\frac{1}{6}$?
(25.) 3 times $\frac{5}{6}$?	(30.) 3 times $1\frac{1}{2}$?	(35.) 10 times $2\frac{1}{20}$?
(26.) 5 times $\frac{3}{10}$?	(31.) 4 times $\frac{5}{16}$?	(36.) 5 times $8\frac{4}{15}$?
(27.) 6 times $\frac{5}{12}$?	(32.) 3 times $\frac{4}{8}$?	(37.) 6 times $9\frac{1}{12}$?

38. If a quart of kerosene will last 4 lamps $\frac{7}{12}$ of an hour, how long would it last 1 lamp ?

39. If 10 horses can cart a lot of gravel in $3\frac{7}{10}$ hours, in what time can 1 horse cart it ?

40. Working 4 hours a day, an accountant balanced his books in $2\frac{5}{8}$ days. How many days would it have taken, working 1 hour a day ?

41. If a field containing $4\frac{7}{15}$ acres is $\frac{1}{5}$ of the land I own, how much land do I own ?

42. Provided 1 dollar will buy $10\frac{7}{16}$ pounds of sugar, how much will 8 dollars buy ?

65. 43. At the rate of $\frac{3}{4}$ of a pound of wool to a yard, how many pounds of wool will be required to make 10 yards of cloth ?

44. How many hours' work will \$20 pay for, if \$1 pays for $3\frac{1}{2}$ hours' work ?

45. There are $16\frac{1}{2}$ feet in a rod. How many feet are there in 5 rods ?

Find the cost

46. Of 5 knives at \$ $\frac{7}{10}$ each, and 2 whetstones at \$ $\frac{3}{10}$ each.

47. Of 6 pounds of tea at \$ $\frac{5}{8}$ a pound, and 4 lamps at \$7$\frac{3}{6}$ each.

48. Of 7 trees at \$1$\frac{3}{10}$ each, and 10 vines at \$1$\frac{2}{10}$ each.

49. Of 3 dozen eggs at \$ $\frac{2}{3}$ per doz., and 2 ploughs at \$5$\frac{5}{8}$ each.

50. Of 5 coats at \$3$\frac{2}{3}$ each, and 6 vests at \$2$\frac{1}{3}$ each.

Find the cost

51. Of 9 charts at $1¾ each, and 12 desks at $4₁³₀ each.

52. Of 4 larks at $¾ each, and 4 canaries at $ 2⅞ each.

53. Of 4 napkins at $₂³₀ each, and 8 rings at $1⅘ each.

54. Of 4 anvils at $8⅞ each, and 1 set (6) spoons at $3¾ a spoon.

55. Of 6 razors at $⅘ each, and 3 chairs at $2₁⁹₀ each.

56. Of 12 balls of twine at $⅜ each, and 6 curtains at $2⅔ each.

66. 57. If 5 oranges be divided equally among 3 boys, what part of the oranges will one boy have? What part will 2 boys have?

58. What is ⅓ of 5? What is ⅔ of 5?

Solution. One third of 5 is ⅝, and ⅔ of 5 is 2 times ⅝, which is ¹⁰⁄₃, or 3⅓. *Ans.* ⅔ of 5 is 3⅓. [See pages 15 and 170.]

NOTE. — Taking ⅓ of a number is called multiplying it by ⅓. The above illustrations show that the expression ⅓ of 5 denotes both multiplying 5 by ⅓ and dividing 5 by 3; hence,

> 5 × ⅓ (12 multiplied by ⅓),
> 5 ÷ 3 (12 divided by 3), and
> ⅓ of 5 all denote the same operation.

59. Find ⅓ of 4.	65. Find ⅘ of 9.	71. Find ₁⁵₂ of 20.
60. Find ⅔ of 4.	66. Find ⅖ of 6.	72. Find ₁³₁ of 5.
61. Find ¼ of 6.	67. Find ⅝ of 7.	73. Find ⅔ of 24.
62. Find ¾ of 6.	68. Find ⅑ of 20.	74. Find ⅞ of 11.
63. Find ⅔ of 4.	69. Find ⅖ of 20.	75. Find ⅝ of 15.
64. Find ⅘ of 7.	70. Find ₁³₀ of 19.	76. Find ⅘ of 13.

77. If a clerk can copy 6 pages in 1 hour, how much can he copy in ⅓ of an hour? in ⅘ of an hour?

78. At $7 a barrel, what is the cost of ⅘ of a barrel of pears?

79. What is the cost of 10¼ bushels of oysters at $2 per bushel?

80. What is the cost of $5\frac{7}{8}$ quarts of cherries at 10 cents a quart ?

81. My horse goes 9 miles an hour. If a steam-car goes $2\frac{6}{9}$ times as fast, how far does the steam-car go in 1 hour ?

82. A boy who planted 6 seeds gathered $12\frac{3}{4}$ times as many. How many did he gather ?

83. How many cents are there in one dollar ? in $\frac{4}{5}$ of a dollar ? How many in $\frac{3}{4}$ of a dollar ? in $\frac{5}{8}$ of a dollar ?

What is the cost

84. Of $\frac{1}{4}$ dozen collars at \$3 a dozen ? at \$5 a dozen ?

85. Of $\frac{3}{7}$ barrel of flour at \$7 a barrel ? at \$11 a barrel ?

86. Of $\frac{3}{4}$ dozen napkins at \$8 a dozen ? at \$9 a dozen ?

87. What is $\frac{3}{4}$ of $\frac{6}{7}$?

Solution. $\frac{1}{4}$ of $\frac{6}{7}$ is $\frac{6}{28}$, and $\frac{3}{4}$ of $\frac{6}{7}$ is 3 times $\frac{6}{28}$, which is $\frac{18}{28}$, or $\frac{9}{14}$. *Ans.* $\frac{3}{4}$ of $\frac{6}{7}$ is $\frac{9}{14}$.

What is

(88.) $\frac{3}{4}$ of $\frac{8}{11}$?	(92.) $\frac{10}{13}$ of $\frac{9}{7}$?	(96.) $\frac{2}{7}$ of $3\frac{1}{3}$ ($=\frac{10}{3}$) ?
(89.) $\frac{4}{7}$ of $\frac{9}{7}$?	(93.) $\frac{5}{6}$ of $1\frac{3}{4}$?	(97.) $\frac{7}{8}$ of $4\frac{4}{5}$ ($=\frac{24}{5}$) ?
(90.) $\frac{3}{7}$ of $1\frac{4}{5}$?	(94.) $\frac{4}{9}$ of $2\frac{7}{8}$?	(98.) $\frac{5}{6}$ of $5\frac{1}{3}$?
(91.) $\frac{7}{8}$ of $\frac{4}{5}$?	(95.) $\frac{4}{11}$ of $2\frac{2}{3}$?	(99.) $\frac{2}{11}$ of $3\frac{3}{10}$?

100. Multiply $10\frac{2}{7}$ by $\frac{7}{12}$.	103. What is $4\frac{1}{3}$ times $3\frac{3}{4}$?
101. Multiply $8\frac{3}{4}$ by $\frac{5}{6}$.	104. What is $8\frac{1}{3}$ times 6 ?
102. Multiply $3\frac{1}{5}$ by $1\frac{2}{3}$.	105. What is $12\frac{1}{2}$ times 10 ?

106. Find $\frac{9}{7}$ of $15\frac{3}{4}$.

NOTE. — $15\frac{3}{4} = 14 + 1\frac{3}{4}$. It may be more convenient for the pupil to get $\frac{9}{7}$ of 14, and then $\frac{9}{7}$ of $1\frac{3}{4}$.

107. Find $\frac{3}{4}$ of $18\frac{1}{2}$.	109. Find $\frac{5}{11}$ of $47\frac{3}{10}$.
108. Find $\frac{5}{8}$ of $28\frac{4}{5}$.	110. Find $\frac{7}{12}$ of $92\frac{4}{7}$.

111. What should be paid for $\frac{2}{3}$ of a day's work at \$ $\frac{9}{16}$ per day ?

112. If ⅔ of a yard of silk was made into 5 equal squares, how much did 1 square contain? How much did 4 squares contain?

113. Myra's hat cost $2⅔; Josie's cost ⅔ as much. What did Josie's cost?

114. Ruth lives 1⅘ of a mile from school. Lucy lives ⅞ that distance on the same road. What part of a mile does Lucy walk to go to school? What part of a mile to go to Ruth's?

115. The old New England shilling was 16⅔ cents; that of New York was ¾ as much. How much was the old New York shilling?

67. 116. If Mrs. Vance divided ⅓ of a pie equally between her 2 children, what part of the pie did each child have?

What is ½ of ⅓?

Solution. If each third be divided into 2 equal parts, 3 thirds or the whole one will be divided into 3 times 2, which is 6 equal parts; hence, ½ of ⅓ is ⅙. *Ans.* ⅙.

[See page 00 for second solution.]

NOTE. — Taking ½ of ⅓ is called multiplying ⅓ by ½. Hence, the statement in note, Art. 66, applies to this article.

117. What is ½ of ½? ⅓ of ½? ½ of ¼?

118. What is ½ of ⅓? ⅙ of ½? ⅓ of ⅙?

119. What is ½ of ⅛? ½ of 1/10? ⅓ of ¼?

In getting ⅙ of ¼, how was the denominator of the answer found?

What part of a whole thing are

120. Fifths of fourths? thirds of tenths? sevenths of fifths?

121. Thirds of sixths? sixths of sixths? ninths of sixths?

122. Fifths of fifths? fourths of tenths? tenths of tenths?

Give answers to the following:

(123.) ⅓ of ⅙ = ? ⅙ multiplied by ⅓ = ? ⅙ ÷ 3 = ?

(124.) 1/10 of ¼ = ? ¼ multiplied by ⅙ = ? ¼ ÷ 8 = ?

(125.) ⅑ of ⅛ = ? 1/12 multiplied by 1/12 = ? 1/12 ÷ 9 = ?

126. What is the cost of $\frac{1}{2}$ dozen cravats at $\$\frac{1}{2}$ a dozen ?

127. A man owning $\frac{1}{3}$ of a ship sold $\frac{1}{4}$ of his share.   What part of the ship did he sell ?

128. If $\frac{1}{5}$ of the royalty on a machine is shared equally by 3 persons, what part has each person ?

129. What is $\frac{1}{5}$ of $\frac{3}{4}$? $\frac{3}{5}$ of $\frac{3}{4}$?

Solution. $\frac{1}{5}$ of $\frac{1}{4}$ is $\frac{1}{20}$, $\frac{1}{5}$ of $\frac{3}{4}$ is $\frac{3}{20}$, and $\frac{3}{5}$ of $\frac{3}{4}$ is 3 times $\frac{3}{20}$, which is $\frac{9}{20}$.   *Ans.* $\frac{3}{5}$ of $\frac{3}{4}$ is $\frac{9}{20}$.   [See page 170 for second solution.]

130. What is $\frac{1}{2}$ of $\frac{3}{4}$? $\frac{1}{4}$ of $\frac{3}{2}$? $\frac{2}{3}$ of $\frac{1}{4}$?
131. What is $\frac{4}{3}$ of $\frac{3}{7}$? $\frac{3}{4}$ of $\frac{5}{8}$? $\frac{7}{9}$ of $\frac{3}{5}$?
132. What is $\frac{3}{5}$ of $\frac{4}{5}$? $\frac{5}{6}$ of $\frac{3}{8}$? $\frac{3}{4}$ of $\frac{5}{7}$?

In finding $\frac{2}{3}$ of $\frac{4}{5}$, what numbers are multiplied together to get the new denominator, 15 ?   What numbers are multiplied together to get the new numerator, 8 ?

What is

(133.) $\frac{5}{7}$ of $\frac{2}{3}$?	(136.) $\frac{3}{10}$ multiplied by $\frac{2}{3}$?	(139.) $2\frac{1}{4} \times 2\frac{1}{4}$?
(134.) $\frac{3}{8}$ of $\frac{2}{3}$?	(137.) $\frac{4}{11}$ multiplied by $\frac{3}{4}$?	(140.) $1\frac{1}{5} \times 1\frac{1}{6}$?
(135.) $\frac{7}{9}$ of $\frac{1}{12}$?	(138.) $\frac{3}{3}$ multiplied by $\frac{5}{8}$?	(141.) $4\frac{3}{4} \times 1\frac{3}{4}$?

142. A boy was promised $\$\frac{3}{4}$ a day for his work.   If he worked $\frac{1}{2}$ day, how much should he receive ?

143. Willie worked $\frac{3}{2}$ days at picking peas; Frank worked $\frac{3}{4}$ as long.   How much time did Frank work ?

144. If $\$1$ pays for $\frac{7}{10}$ of a day's work, for what part of a day's work will $\$\frac{4}{5}$ pay ?

145. Four men shared equally in paying for a meal which cost $\$2\frac{1}{5}$.   What was the share of each ?

146. A tailor having $\frac{2}{3}$ of a bale of cloth, sold $\frac{3}{7}$ of it.   What part of the bale did he sell ?

147. In 1 rod are $16\frac{1}{2}$ feet.   In $\frac{3}{4}$ of a rod are how many feet ?

NOTE. — Take $\frac{3}{4}$ of 16, then take $\frac{3}{4}$ of $\frac{1}{2}$.

148. I paid $5⅔ for repairing my watch, and ⅞ as much for repairing my glasses. How much did I pay for repairing my glasses?

149. Water weighs 62½ pounds a cubic foot. How many pounds in ⅛ of a cubic foot?

150. The four sides of a square lot of land measure 66⅔ rods. What is the length of one side?

151. A man rowed 3½ miles in 1 hour. At the same rate, how far could he row in 2⅕ hours?

152. If 6¼ yards of ribbon can be bought for $1, how much can be bought for ⅞ of a dollar?

153. If a bushel of peas sells for $1¼, for what will 1½ bushels sell?

154. A piece of wall 2¹¹⁄₁₁ rods long was built in one day. How much could be built in 1⅓ days at the same rate?

155. When 1¾ bushels of potatoes will pay for a bag of corn, how many bushels of potatoes will pay for 2⅞ bags of corn?

156. If 2 towns shared equally in building ⅔ of ¼ of a road, what was the share of each town?

157. What is ½ of ⅔ of ¼ of a thing?

158. Having $⅔, Mr. Drew gave ⅞ of it to Susan and ¾ as much to Mary. What part of the money did he give to Mary?

159. What is ¾ of ⅞ of ⅔ of a number?

160. What is ½ of ½ of ½?   167. What is ⅔ × ⅞ × 2½?
161. What is ½ of ⅔ of ⅓?   168. What is ⅓ × ¾ × 5½?
162. What is ⅓ of ½ of ⅜?   169. What is ⅜ × ½ × 2⅔?
163. What is ¾ of ½ of ¼?   170. What is ¾ × ⅞ × 4½?
164. What is ⅜ of ⅔ of ⅝?   171. What is ⅔ × ⅘ × 1⅝?
165. What is ⁵⁄₉ of ½ of ¾?   172. Find ½ × ⅓ × ½ × ⅓.
166. What is ⅔ of ⅔ of ⁹⁄₄?   173. Find ⅓ × ½ × ½ × ⅓.

SECTION XXVII.

DIVISION OF FRACTIONS.

68. 1. How many times is $\frac{2}{3}$ contained in 4 ?

Solution. 4 equals $\frac{12}{3}$; $\frac{2}{3}$ is contained in $\frac{12}{3}$ as many times as 2 is contained times in 12, which is 6. *Ans.* 6 times. [See page 170, for second solution.]

2. How many times is $\frac{1}{3}$ contained in 2 ? in 5 ? How many times is $\frac{1}{4}$ contained in 3 ? in 4 ?

3. How many times is $\frac{3}{4}$ contained in 3 ? in 5 ?

4. How many times is $\frac{2}{7}$ contained in 3 ? in 4 ?

5. Three is how many times $\frac{1}{2}$? $\frac{3}{2}$? $\frac{5}{6}$?

6. Four is how many times $\frac{3}{7}$? $\frac{3}{10}$? $\frac{5}{11}$?

7. Five is how many times $\frac{3}{4}$? $\frac{5}{8}$? $\frac{7}{12}$?

8. Divide 8 by $\frac{4}{8}$; 7 by $\frac{3}{4}$; 10 by $\frac{7}{10}$; 4 by $\frac{5}{12}$.

9. How many yards of fringe at $\$\frac{3}{8}$ a yard can be bought for $\$3$?

10. How many bags, each containing $\frac{3}{4}$ of a gill, can be filled from 8 gills of seeds ?

11. If chairs can be seated at $\$\frac{4}{5}$ each, how many can be seated for $\$6$?

12. Fencing being $\$2\frac{1}{3}$ per rod, how many rods can be built for $\$7$?

13. One peach being worth $\frac{3}{7}$ as much as an orange, how many peaches will pay for 1 dozen oranges ?

14. In a cleft of wood 6 feet long, how many sticks each $1\frac{1}{2}$ feet long ?

15. How many jugs, each containing $1\frac{3}{7}$ gallons, will hold 12 gallons of vinegar ?

16. How many bushels of parsneps, at $\$\frac{3}{4}$ a bushel, can be bought for $\$3$?

17. If Helen can knit $\frac{4}{7}$ of a scarf in 1 day, in how many days can she knit 6 scarfs?

18. If a cooper can set up barrels at the rate of 1 in $\frac{3}{10}$ of an hour, how many can he set up in 9 hours?

19. How many times is $\frac{2}{3}$ contained in $\frac{3}{4}$?

Solution. $\frac{2}{3}$ and $\frac{3}{4}$ changed to fractions having a common denominator equal $\frac{8}{12}$ and $\frac{9}{12}$; $\frac{8}{12}$ is contained in $\frac{9}{12}$ as many times as 8 is contained times in 9, which is $\frac{9}{8}$, or $1\frac{1}{8}$ times. *Ans.* $1\frac{1}{8}$ times. [For second solution, see page 170.]

How many times

20. $\frac{2}{3}$ in $\frac{4}{5}$?	24. $\frac{3}{4}$ in $\frac{5}{8}$?	28. $\frac{3}{8}$ in $\frac{5}{6}$?
21. $\frac{5}{8}$ in $\frac{5}{6}$?	25. $\frac{5}{7}$ in $\frac{2}{3}$?	29. $\frac{5}{6}$ in $\frac{7}{3}$?
22. $\frac{1}{2}$ in $\frac{5}{9}$?	26. $\frac{5}{6}$ in $\frac{5}{9}$?	30. $\frac{3}{4}$ in $2\frac{1}{3}$ $(= \frac{7}{3})$?
23. $\frac{5}{7}$ in $\frac{3}{4}$?	27. $\frac{4}{5}$ in $\frac{7}{10}$?	31. $\frac{5}{8}$ in $2\frac{3}{5}$?

32. Divide $2\frac{3}{5}$ by $1\frac{1}{3}$.	34. Divide $3\frac{5}{6}$ by $4\frac{1}{2}$.
33. Divide $6\frac{3}{4}$ by $5\frac{1}{3}$.	35. Divide $1\frac{3}{8}$ by $4\frac{1}{5}$.

36. Divide $12\frac{1}{2}$ by 5.

NOTE. — $12\frac{1}{2}$ divided by 5 equals $\frac{25}{2} \div \frac{10}{2} = 2\frac{1}{2}$.

37. Divide $16\frac{1}{2}$ by 11.	39. Divide $3\frac{1}{3}$ by 8.
38. Divide $4\frac{1}{3}$ by 3.	40. Divide $\frac{3}{13}$ by 10.

41. At $\$\frac{3}{10}$ an hour for the use of a boat, for how much time will $\$\frac{4}{5}$ pay?

42. If butter is $\$\frac{2}{3}$ a pound, how many pounds can be bought for $\$1\frac{1}{4}$?

43. Howard divided $\$\frac{3}{4}$ among some poor children, giving them $\$\frac{3}{10}$ each. How many children were there?

44. If a milliner puts $\frac{2}{5}$ of a yard of wire into one hat, how many hats can she wire with $2\frac{1}{2}$ yards?

45. How many strips, each $2\frac{1}{4}$ feet long, can we cut from a piece of moulding $13\frac{1}{2}$ feet long?

46. When $\frac{2}{3}$ of a pound of cotton makes 1 yard of cloth, how much will $6\frac{2}{3}$ pounds make?

47. How many blocks, each $\frac{3}{8}$ of an inch long, can be sawed from a strip $3\frac{3}{4}$ inches long?

48. When potatoes are worth $2\frac{2}{3}$ a barrel, what quantity of potatoes will $\frac{9}{10}$ buy?

49. How many times will a wheel $3\frac{1}{3}$ yards in circumference turn in going a distance of $5\frac{5}{7}$ yards?

50. Rose had $1\frac{1}{4}$ and received $\frac{2}{3}$ more. How many yards of muslin, at $\frac{2}{3}$ a yard, could she buy with her money?

51. How many steps, $2\frac{3}{4}$ feet each, in a rod, or $16\frac{1}{2}$ feet?

52. A man laid $12\frac{1}{2}$ rods of wall, averaging $2\frac{1}{4}$ rods per day. How many days did it take?

53. When coal is $7\frac{1}{2}$ per ton, how much coal can be bought for $2\frac{1}{2}$? for $1\frac{4}{4}$?

54. At $2\frac{1}{10}$ dimes per pound, how many pounds of sugar can be bought for $8\frac{2}{3}$ dimes?

55. At $2 per gross, how many gross of buttons can be bought for $7\frac{3}{4}$? What part of a gross can be bought for $\frac{1}{3}$?

56. When coal is $7 per ton, what part of a ton can be bought for $2\frac{2}{4}$?

Miscellaneous.

69. Find the answers to the following:

(57.) $\frac{4}{5} \times 2$	(66.) $5\frac{1}{2} \div 5$	(75.) $16\frac{2}{3} - 7\frac{3}{10}$	(84.) $\frac{3}{4}$ of $\frac{4}{5}$
(58.) $\frac{9}{10} \div 3$	(67.) $5\frac{1}{2} \div \frac{1}{5}$	(76.) $\frac{4}{7} \div 9$	(85.) $1\frac{1}{2} \times 1\frac{1}{2}$
(59.) $\frac{1}{2} \div 4$	(68.) $5\frac{1}{2} \times 5$	(77.) $3 \div \frac{2}{3}$	(86.) $2\frac{1}{2} \times 2\frac{1}{2}$
(60.) $\frac{1}{5}$ of 5	(69.) $\frac{1}{5}$ of $5\frac{1}{2}$	(78.) $1 - \frac{1}{15}$	(87.) $1\frac{3}{4} \times 2\frac{1}{4}$
(61.) $\frac{1}{7}$ of $\frac{2}{3}$	(70.) $9\frac{1}{3} \times 6$	(79.) $2 \div \frac{2}{3}$	(88.) $8\frac{1}{4} \div \frac{2}{3}$
(62.) $\frac{4}{5} \times \frac{3}{4}$	(71.) $10\frac{1}{2} \div 7$	(80.) $3 \div \frac{1}{5}$	(89.) $\frac{2}{3}$ of $8\frac{1}{4}$
(63.) $\frac{1}{2}$ of $7\frac{1}{2}$	(72.) $\frac{1}{4}$ of $9\frac{1}{3}$	(81.) $3 \div \frac{5}{8}$	(90.) $1\frac{1}{3} \div 7\frac{1}{2}$
(64.) $2\frac{1}{2} \times \frac{4}{5}$	(73) $11 \times 11\frac{4}{5}$	(82.) $4\frac{1}{2} \div \frac{4}{7}$	(91.) $1\frac{4}{7} \div 2\frac{1}{4}$
(65.) $\frac{5}{8} \div 1\frac{1}{3}$	(74.) $\frac{7}{12} + \frac{5}{8}$	(83.) $4\frac{1}{2} \times \frac{7}{8}$	(92) $4\frac{2}{3} \div 1\frac{1}{2}$

SECTION XXVIII.

RELATIONS OF NUMBERS.

70. 1. Mr. Fox having 6 sheep, sheared 3 of them, while his son sheared 2, and 1 remained to be sheared. What part of the sheep remained to be sheared? What part did Mr. Fox shear? What part did his son shear?

>   NOTE. — Express the answers in their smallest terms.

2. What part of 6 is 1? of 6 is 3? of 6 is 2?
3. What part of 8 is 4? of 8 is 2? of 8 is 6?
4. What part of 12 is 6? of 12 is 4? of 12 is 3?
5. What part of 4 is 3? of 3 is 4? of 3 is 5?

From the above, it will be seen that, in finding the part which one number is of another, *the number which is the part is made the numerator, and the number with which it is compared is made the denominator of a fraction.*

6. If 6 bunches of friction matches cost 9 cents, what part of 9 cents will 4 bunches cost? How many cents?

Solution. If 6 bunches cost 9 cents, 4 bunches, which is $\frac{2}{3}$ of 6 bunches, will cost $\frac{2}{3}$ of 9 cents, which is 6 cents. *Ans.* 6 cents.

7. If 8 pairs of shoes cost $12, what part of $12 will 6 pairs cost? How many dollars?

8. The cost of keeping a cow for 5 months being $11, what is the cost of keeping her for 10 months?

71. 9. In a mill are two looms running at the same speed; one weaves cloth 2 yards wide, the other $\frac{3}{4}$ of a yard wide. In a given time, what part as much will the second weave as the first? What part of 2 is $\frac{3}{4}$?

Solution. 2 equals $\frac{8}{4}$; $\frac{3}{4}$ is the same part of $\frac{8}{4}$ that 3 is of 8, which is $\frac{3}{8}$. *Ans.* $\frac{3}{8}$.

10. What part of 2 is $\frac{2}{3}$? of 3 is $\frac{3}{4}$? of 3 is $\frac{2}{5}$?

11. What part of 4 is $\frac{2}{3}$? of 2 is $\frac{4}{5}$? of 5 is $\frac{2}{3}$?

12. What part of 6 is $\frac{2}{7}$? of 7 is $\frac{3}{5}$? of 3 is $1\frac{1}{2}$?

13. What part of 10 is $3\frac{1}{3}$? of 10 is $2\frac{1}{2}$?

14. If coal is $5 a ton, what part of a ton will $$\frac{3}{4}$$ buy ?

15. Eva was promised a writing desk costing $6 when she had earned 1\frac{1}{2}$ towards paying for it. For what part of the desk was she expected to pay ?

16. A mason used $1\frac{1}{4}$ bushels of lime to every 4 bushels of mortar. What part of the mortar was lime ?

17. Reckoning a day 10 hours, and the wages of a man $4 a day, what should be paid a man for $7\frac{1}{2}$ hours' work ?

> Note. — First find what part of a day $7\frac{1}{2}$ hours is.

18. If, by going a mile in 4 minutes, a traveller can reach his destination in 8 hours, in what time can he reach it by going a mile in $3\frac{1}{2}$ minutes ?

19. What part of $\frac{3}{4}$ is $\frac{2}{3}$?

> Note. — Change $\frac{3}{4}$ and $\frac{2}{3}$ to a common denominator.   *Ans.* $1\frac{1}{8}$.
> [For second solution, see page 170.]

What part

20. Of $\frac{2}{3}$ is $\frac{2}{5}$?	24. Of $\frac{3}{4}$ is $\frac{2}{5}$?	28. Of $\frac{3}{5}$ is $\frac{5}{6}$?
21. Of $\frac{3}{5}$ is $\frac{1}{4}$?	25. Of $\frac{3}{8}$ is $\frac{1}{4}$?	29. Of $1\frac{1}{2}$ is $\frac{5}{9}$?
22. Of $\frac{4}{5}$ is $\frac{2}{3}$?	26. Of $\frac{4}{9}$ is $\frac{2}{3}$?	30. Of $\frac{5}{9}$ is $1\frac{1}{2}$?
23. Of $\frac{1}{2}$ is $\frac{3}{7}$?	27. Of $\frac{9}{10}$ is $\frac{5}{8}$?	31. Of $7\frac{1}{2}$ is $3\frac{1}{2}$?

32. A piece of floating ice $1\frac{1}{3}$ feet thick was found to have $\frac{1}{6}$ of a foot above water. What part of its depth was above water ?

33. A man who owned $\frac{7}{8}$ of a schooner sold $\frac{1}{2}$ of her. What fractional part of what he owned did he sell ?

34. Cucumbers which cost $$\frac{1}{4}$$ a dozen suddenly fell in the market and were sold at $$\frac{1}{20}$$ a dozen. What part of their cost did they bring ?

35. A plumber furnished valves at 1\frac{1}{2}$ which cost him 1\frac{1}{4}$ each. What fraction of the cost was his gain ?

SECTION XXIX.

A PART GIVEN, TO FIND THE WHOLE.

72. 1. A vessel made $\frac{1}{2}$ of her voyage in $6\frac{1}{2}$ days. In what time could she make the whole voyage ?

2. In $\frac{1}{8}$ of a rod there are $5\frac{1}{2}$ feet. In a whole rod, how many feet ?

3. Coffee is sold at a profit of $1\frac{2}{5}$ on a bag. If this is $\frac{1}{5}$ of the cost, what was the cost ?

4. A share of bank-stock is worth $16\frac{2}{3}$. If this is $\frac{1}{6}$ of its original value, what was that value ?

5. My coat cost $\frac{6}{5}$ as much as my hat, and the difference of their cost was $3\frac{1}{4}$. What was the cost of the coat ?

(6.) $5\frac{1}{2}$ is $\frac{1}{6}$ of what number ?   (8.) $8\frac{1}{4}$ is $\frac{1}{12}$ of what ?
(7.) $6\frac{3}{8}$ is $\frac{1}{3}$ of what number ?   (9.) $12\frac{1}{2}$ is $\frac{1}{7}$ of what ?

10. What costs a barrel of fish, if $\frac{3}{4}$ of a barrel costs $4\frac{2}{5}$?

11. If $\frac{4}{5}$ will pay for $1\frac{9}{16}$ pounds of soap, for how much will $1 pay ?

12. I paid $3\frac{3}{4}$ for $\frac{5}{6}$ of a day's work. What would be paid for a day's work at the same rate ?

13. Alice has read $62\frac{1}{2}$ pages of her Latin, which is $\frac{5}{12}$ of the whole book. How many pages are there in the book ?

(14.) $2\frac{1}{2}$ is $\frac{5}{6}$ of what number ?   (21.) $18\frac{3}{4}$ is $\frac{3}{8}$ of what ?
(15.) $4\frac{2}{3}$ is $\frac{7}{8}$ of what number ?   (22.) $37\frac{1}{2}$ is $\frac{3}{4}$ of what ?
(16.) $4\frac{2}{5}$ is $\frac{4}{5}$ of what number ?   (23.) $9\frac{3}{4}$ is $\frac{5}{8}$ of what ?
(17.) $2\frac{1}{7}$ is $\frac{3}{7}$ of what number ?   (24.) $33\frac{1}{3}$ is $\frac{10}{9}$ of what ?
(18.) $62\frac{1}{2}$ is $\frac{5}{7}$ of what number ?   (25.) $\frac{3}{4}$ is $\frac{7}{8}$ of what ?
(19.) $66\frac{2}{3}$ is $\frac{2}{3}$ of what number ?   (26.) $\frac{8}{11}$ is $\frac{5}{13}$ of what ?
(20.) $83\frac{1}{3}$ is $\frac{10}{12}$ of what number ?   (27.) $\frac{3}{4}$ is $\frac{5}{8}$ of what ?

28. If $\frac{1}{8}$ of an acre of land sells for $21, what will a whole acre sell for ? How many sheep at $2 each will pay for an acre ?

29. Four fifths of a person's wages for a month are $28. How many weeks' board, at $3 a week, can he pay with the wages for one month ?

(30.) 28 is $\frac{4}{5}$ of how many times 3 ?

(31.) 42 is $\frac{6}{9}$ of how many times 8 ?

(32.) 44 is $\frac{11}{3}$ of how many times 10 ?

(33.) 54 is $\frac{9}{11}$ of how many times 12 ?

(34.) 80 is $\frac{10}{9}$ of how many times 9 ?

(35.) 110 is $\frac{10}{11}$ of how many times 12 ?

(36.) 56 is $\frac{7}{4}$ of how many times 16 ?

37. Jane had 24 cents, and spent $\frac{3}{4}$ of her money for pencils at 9 cents apiece. How much money did she spend for the pencils ? How many pencils did she get ?

38. George had 42 apples, and gave $\frac{5}{7}$ of them for fish-hooks, giving 3 apples for 1 fish-hook. How many fish-hooks did he get ?

(39.) $\frac{5}{7}$ of 42 is how many times 3 ?

(40.) $\frac{5}{12}$ of 36 is how many times 5 ?

(41.) $\frac{6}{7}$ of 35 is how many times 6 ?

(42.) $\frac{3}{8}$ of 64 is how many times 7 ?

(43.) $\frac{6}{10}$ of 70 is how many times 8 ?

(44.) $\frac{9}{11}$ of 33 is how many times 9 ?

45. Annie found 35 early violets, and $\frac{6}{9}$ of the number she found was $\frac{2}{3}$ of the number Maggie found. How many did Maggie find ?

(46.) $\frac{6}{8}$ of 25 is $\frac{5}{4}$ of what number ?

(47.) $\frac{4}{9}$ of 18 is $\frac{2}{11}$ of what number ?

(48.) $\frac{8}{13}$ of 26 is $\frac{4}{5}$ of what number ?

(49.) $\frac{3}{4}$ of 28 is $\frac{7}{12}$ of what number ?

(50.) $\frac{1}{12}$ of 48 is $\frac{4}{5}$ of what number ?

51. If $\frac{1}{3}$ of a yard of silk weighs $1\frac{1}{4}$ ounces, what will 10 yards weigh?

52. If $\frac{1}{6}$ of a rod of wall can be laid in $2\frac{1}{3}$ hours, in what time can 5 rods be laid?

53. If $\frac{1}{5}$ of a barrel of beef will last a family 3 months, how long will $2\frac{1}{2}$ barrels last the family?

54. If $\frac{3}{4}$ of a cord of wood costs $6, what will 7 cords cost?

55. Mr. Wing sold 2 colts for $44, which was $\frac{4}{3}$ of what he paid for them. What did he pay for them?

56. I paid 5\frac{5}{8}$ for a sheep, which was $\frac{3}{7}$ of what I received for a heifer. What did I receive for the heifer?

57. If a man can walk $\frac{3}{7}$ of a mile in $7\frac{1}{2}$ minutes, in what time can he walk 5 miles?

58. The distance from Bourne to Reese is $\frac{3}{8}$ of the distance from Bourne to Saxton by the same route. If the distance from Reese to Saxton is 20 miles, what is the distance from Bourne to Saxton?

59. A child is $2\frac{1}{2}$ years old. If he is $\frac{1}{10}$ as old as his mother, and his mother is $\frac{4}{9}$ as old as his father, how old is his father?

60. There is a barber's pole, $4\frac{3}{4}$ feet of which is painted white, 8 feet is striped, and the remainder, which is $\frac{1}{4}$ of the whole pole, is unpainted. What is the length of the pole?

61. After spending $\frac{4}{9}$ of his money, and giving away $\frac{1}{12}$ of it, Albert has 7\frac{3}{10}$ left. How many dollars had he at first?

62. A man mowed $\frac{2}{7}$ of a lot of land, and his boy $\frac{1}{3}$ of it. If the man can mow the rest of it in $2\frac{3}{4}$ hours, in what time could he have mowed the whole?

63. The ages of four children are 13 years, $12\frac{1}{2}$ years, 14 years, and $13\frac{1}{8}$ years, respectively. What is the sum of their ages? What is their average age?

64. A dealer has butter at 27 cents a pound, at 38 cents, and at 32 cents. What is the average price of his butter?

65. If you should work 5 hours to-day, $3\frac{1}{2}$ hours to-morrow, and $5\frac{1}{4}$ hours the next day, what is the average number of hours a day you would work?

SECTION XXX.

MISCELLANEOUS.

73. 1. A driver received $1.25 for carrying a party about the city for $1\frac{1}{4}$ hours. What was the price per hour?

2. Ira received 24 cents for the use of his boat $\frac{4}{5}$ of an hour. What was the price per hour?

3. A man sold $\frac{3}{8}$ of his farm and had 100 acres left. How many acres had he at first?

4. A man having $100 gave $25 for a robe and $\frac{2}{3}$ of the remainder for a harness. How many dollars had he left?

5. A boy paid 36 cents for a brush and $\frac{2}{3}$ as much for a comb. How much did he pay for both?

6. A tax-collector has $\frac{3}{4}$ of a cent for every dollar he collects. How much will be due him on the sum of the following collections: $2; 5\frac{1}{10}$; 12\frac{1}{2}$; 32\frac{2}{3}$?

7. How many oranges at the rate of 3 for 5 cents will pay for 2 dozen apples at 10 cents a dozen?

8. The difference between $\frac{2}{3}$ of a certain number and $\frac{4}{5}$ of it is 6. What is that number?

9. The sum of $\frac{2}{3}$ of a certain number and $\frac{1}{4}$ of it is 52. What is that number?

10. If a quantity of oatmeal will last 6 persons $7\frac{1}{2}$ days, how long will it last 5 persons?

11. If a quantity of corn-meal will last 7 persons $5\frac{1}{2}$ days, how many persons will consume it in $3\frac{1}{2}$ days?

12. A peck of seed peas was put up in bags, each of which held $\frac{4}{5}$ of a gill. How many bags were used?

13. If a wheel $\frac{3}{4}$ of an inch in circumference makes one revolution a second, how many feet will a point on the rim of the wheel move in a minute?

14. At $1\frac{1}{2}$ cents a mile, how far can a person travel for $1?

15. A person travelled at the rate of $2\frac{1}{2}$ cents a mile, and paid 30 cents. How far did he travel?

16. How much of $10 shall I have left after paying for 7 pounds of tea at $$\frac{3}{4}$ a pound?

17. If it costs $25 to fence a lot of land, at $$\frac{5}{8}$ per rod, what will it cost to fence it at $$\frac{1}{3}$ a rod?

18. If a vine grows $\frac{1}{2}$ of $\frac{1}{10}$ of an inch in 10 minutes, how much will it grow in 1 hour, or 60 minutes?

19. If tomatoes are put up in cans, each of which holds $1\frac{1}{2}$ pints, how many cans will be filled from 6 gallons of tomatoes?

20. If 2 boys can shovel a snow-path in $\frac{2}{3}$ of an hour, in what time can 3 boys shovel it?

21. Jane had 20 words for a spelling-lesson every day. She missed $\frac{1}{5}$ of the words on Monday, $\frac{1}{10}$ on Tuesday, $\frac{1}{4}$ on Wednesday, $\frac{2}{5}$ on Thursday, and $\frac{3}{10}$ on Friday. How many words did she miss during the week? What part of the words given her did she miss?

22. James and John shared a box of oranges equally between themselves. James then gave $\frac{1}{2}$ of his share to his mother, $\frac{1}{4}$ to Ada, and $\frac{1}{10}$ to George. What part of the box remained for himself?

23. A man bequeathed $\frac{2}{3}$ of his property to his wife, $\frac{1}{6}$ to his son, $\frac{2}{3}$ of the remainder to his daughter, and the rest to a hospital. What part of his property did he leave to the hospital?

24. If Thomas and George start at the same place, and travel in opposite directions, one at the rate of $6\frac{1}{2}$ miles an hour, and the other at the rate of $7\frac{2}{3}$, how far apart are they in half an hour?

25. $7\frac{1}{2}$ cents is what part of 10 cents?

26. A square lot of land was enclosed by a fence for $$7\frac{1}{2}$. If the cost of the fence was $$\frac{5}{8}$ per rod, what was the length of one side of the lot?

27. Bought 8 yards of velvet, at $$5\frac{3}{10}$ a yard. How much did it cost?

SECTION XXXI.

MULTIPLICATION AND DIVISION OF LARGER NUMBERS.

NOTE. — The exercises in this section are designed to give facility in the analysis of some of the larger numbers.

74. Name the multiples below 100,

1. Of 13.	3. Of 15.	5. Of 17.	7. Of 19.	9. Of 23.
2. Of 14.	4. Of 16.	6. Of 18.	8. Of 21.	10. Of 24.

Give answers to the following:

11. Two 13's ?	21. 2 times 23 ?	31. 13×5 ?	41. 18×4 ?
12. Two 14's ?	22. 3 times 14 ?	32. 15×4 ?	42. 21×4 ?
13. Three 13's ?	23. 2 times 15 ?	33. 21×3 ?	43. 19×4 ?
14. Two 16's ?	24. 3 times 17 ?	34. 14×5 ?	44. 13×7 ?
15. Two 19's ?	25. 2 times 19 ?	35. 15×5 ?	45. 14×7 ?
16. Three 15's ?	26. 3 times 18 ?	36. 13×6 ?	46. 15×6 ?
17. Two 21's ?	27. 4 times 13 ?	37. 17×4 ?	47. 16×6 ?
18. Two 17's ?	28. 3 times 19 ?	38. 16×4 ?	48. 18×5 ?
19. Three 16's ?	29. 4 times 14 ?	39. 14×6 ?	49. 17×5 ?
20. Two 18's ?	30. 3 times 23 ?	40. 16×5 ?	50. 19×5 ?

75. 51. Count by 100's to 10 hundred.

Ten hundred is one thousand, written 1000.
Two thousand is written 2000.
Three thousand is written 3000.
Four thousand, 4000 ; and so on.
Five thousand 2 hundred and 80 is written 5280.

In which place from the right are thousands written ?

Ten thousand is written 10,000.
Twenty thousand is written 20,000, and so on.
Forty-two thousand 2 hundred and 5 is written 42,205.

52. Read the following: 4000; 6000; 5732; 6018; 27,304.
53. Name the multiples of 25 to 250.
54. How many are 5 times 25 ? 8 times 25 ? 25 × 7 ?
25 × 9 ?
55. Name the multiples of 50 to 500.
56. How many are 50 × 5 ? 50 × 7 ? 50 × 9 ? 50 × 8 ?
50 × 6 ?
57. Name the multiples of 60 to 600.
58. How many are 60 × 2 ? 60 × 4 ? 60 × 6 ? 60 × 5 ?

10   30   20   50   60   80   40   90   70

76. Multiply each of the numbers written above

| *a.* By 2. | *c.* By 4. | *e.* By 6. | *g.* By 8. |
| *b.* By 3. | *d.* By 5. | *f.* By 7. | *h.* By 9. |

Multiply the same numbers

| *i.* By 20. | *k.* By 40. | *m.* By 60. | *o.* By 80. |
| *j.* By 30. | *l.* By 50. | *n.* By 70. | *p.* By 90. |

77. 59. How many are two 26's ?

Solution.   Two 20's are 40 and two 6's are 12, which added to 40,
is 52.   *Ans.* 52.

60. How many are two 37's ? 75's ? 33's ? 72's ?
61. How many are three 54's ? 48's ? 63's ? 28's ?
62. How many are four 36's ? 32's ? 75's ? 44's ?
63. How many are five 24's ? 72's ? 25's ? 96's ?
64. How many are 24 × 6 ? 54 × 6 ? 25 × 6 ? 36 × 6 ?
65. How many are 18 × 7 ? 49 × 7 ? 16 × 8 ? 18 × 8 ?
66. How many are 45 × 8 ? 16 × 9 ? 64 × 8 ? 81 × 9 ?

78. 67. What is 2 times 2? 3 times 3?

A number, as 4 or 9, found by multiplying two equal factors together, is the *square* of the number multiplied.

68. Give the squares of the numbers from 2 to 12.

69. What is the square of $\frac{1}{2}$? $\frac{1}{3}$? $\frac{1}{4}$? $\frac{1}{5}$? $\frac{1}{6}$? $\frac{1}{7}$? $\frac{1}{8}$? $\frac{1}{9}$? $\frac{1}{10}$? $\frac{1}{11}$? $\frac{1}{12}$?

70. What is the square of $\frac{2}{3}$? $\frac{3}{4}$? $1\frac{1}{2}$? $2\frac{1}{2}$? $3\frac{1}{2}$?

71. What is 2 times 2 times 2? 3 times 3 times 3?

A number, as 8 or 27, found by multiplying three equal factors together, is the *cube* of the number multiplied.

72. Find the cubes of the numbers from 1 to 9.

73. What is the cube of $\frac{1}{2}$? $\frac{1}{3}$? $\frac{1}{4}$? $\frac{1}{5}$? $\frac{1}{6}$?

79. Of the numbers written below, find such fractional parts as are indicated:

74. Of 120 find $\frac{1}{2}$; $\frac{1}{4}$; $\frac{1}{8}$; $\frac{1}{3}$; $\frac{1}{6}$; $\frac{1}{24}$; $\frac{1}{5}$; $\frac{1}{20}$; $\frac{1}{40}$; $\frac{1}{15}$; $\frac{1}{30}$.

75. Of 128 find $\frac{1}{2}$; $\frac{1}{4}$; $\frac{1}{8}$; $\frac{1}{16}$; $\frac{1}{32}$; $\frac{1}{64}$.

76. Of 144 find $\frac{1}{2}$; $\frac{1}{4}$; $\frac{1}{8}$; $\frac{1}{16}$; $\frac{1}{3}$; $\frac{1}{24}$; $\frac{1}{9}$; $\frac{1}{18}$; $\frac{1}{36}$; $\frac{1}{72}$.

77. Of 150 find $\frac{1}{2}$; $\frac{1}{4}$; $\frac{1}{3}$; $\frac{1}{6}$; $\frac{1}{12}$; $\frac{1}{5}$; $\frac{1}{10}$; $\frac{1}{15}$; $\frac{1}{30}$; $\frac{1}{25}$; $\frac{1}{50}$.

78. Of 160 find $\frac{1}{2}$; $\frac{1}{4}$; $\frac{1}{8}$; $\frac{1}{16}$; $\frac{1}{32}$; $\frac{1}{5}$; $\frac{1}{10}$; $\frac{1}{20}$; $\frac{1}{40}$; $\frac{1}{80}$.

79. Of 200 find $\frac{1}{2}$; $\frac{1}{4}$; $\frac{1}{8}$; $\frac{1}{5}$; $\frac{1}{10}$; $\frac{1}{20}$; $\frac{1}{40}$; $\frac{1}{25}$; $\frac{1}{50}$; $\frac{1}{100}$.

80. Of 360 find $\frac{1}{2}$; $\frac{1}{4}$; $\frac{1}{8}$; $\frac{1}{3}$; $\frac{1}{6}$; $\frac{1}{12}$; $\frac{1}{10}$; $\frac{1}{30}$; $\frac{1}{60}$; $\frac{1}{120}$.

81. Of 500 find $\frac{1}{2}$; $\frac{1}{4}$; $\frac{1}{8}$; $\frac{1}{5}$; $\frac{1}{10}$; $\frac{1}{20}$; $\frac{1}{25}$; $\frac{1}{50}$; $\frac{1}{125}$.

82. Of 100 find $\frac{1}{2}$; $\frac{1}{4}$; $\frac{1}{8}$; $\frac{1}{16}$; $\frac{1}{5}$; $\frac{1}{6}$; $\frac{1}{4}$; $\frac{1}{20}$; $\frac{2}{3}$; $\frac{3}{8}$; $\frac{5}{8}$; $\frac{7}{8}$.

83. What part of 100 is 5? 10? 20? 25? 30? 60? 80?

84. What part of 100 is $16\frac{2}{3}$? $33\frac{1}{3}$? $12\frac{1}{2}$? $37\frac{1}{2}$? $62\frac{1}{2}$?

85. Of 1000 find $\frac{1}{2}$; $\frac{1}{4}$; $\frac{1}{8}$; $\frac{1}{16}$; $\frac{2}{3}$; $\frac{1}{5}$; $\frac{2}{5}$; $\frac{3}{8}$; $\frac{3}{8}$; $\frac{5}{8}$; $\frac{7}{8}$.

86. Of 1000 find $\frac{1}{20}$; $\frac{1}{40}$; $\frac{1}{500}$; $\frac{1}{250}$; $\frac{1}{100}$; $\frac{1}{25}$; $\frac{1}{5}$; $\frac{2}{5}$.

87. What part of 1000 is 200? 400? 600? 800?

88. What part of 1000 is 250? 750? 125? 375? 625? $333\frac{1}{3}$? $666\frac{2}{3}$?

89. To make 1000, what must be added to 400? 650? 570? 280? 475? 136? 913? 347? 695? 262? 821? 559? 708?

SECTION XXXII.

UNITED STATES MONEY.

80. Repeat the following table :

<div align="center">

10 mills	=	1 cent, ₡.
10 cents	=	1 dime, d.
10 dimes	=	1 dollar, $.
10 dollars	=	1 eagle, E.
100 cents	=	1 dollar.

</div>

United States money is generally reckoned in dollars and cents.

15 dollars and 32 cents are written together, thus : $15.32.
7 dollars and 8 cents are written together, thus : $7.08.
$12.30 is read " twelve dollars and thirty cents."
$2.03 is read " two dollars and three cents."

Mills are written at the right of cents.

$4.125 is read " four dollars twelve cents and five mills."

Read the following :

1. \$ 52.62
2. \$ 51.02
3. \$ 18.36
4. \$ 83.25
5. \$ 72.09
6. \$ 14.42
7. \$ 5.20
8. \$ 9.09
9. \$ 13.925
10. \$ 46.107

81. 11. How many cents are there in \$1 ? \$$\frac{1}{2}$$? \$$\frac{1}{4}$$? \$$\frac{3}{4}$$?

12. How many cents are there in \$$\frac{1}{5}$$? \$$\frac{2}{5}$$? \$$\frac{3}{5}$$? \$$\frac{4}{5}$$?

13. How many cents are there in \$$\frac{1}{10}$$? \$$\frac{3}{10}$$? \$$\frac{4}{10}$$? \$$\frac{7}{10}$$?

14. How many cents are there in \$$\frac{1}{20}$$? \$$\frac{3}{20}$$? \$$\frac{7}{20}$$? \$$\frac{11}{20}$$?

15. How many cents are there in \$$\frac{1}{25}$$? \$$\frac{4}{25}$$? \$$\frac{7}{25}$$? \$$\frac{9}{25}$$?

16. How many cents are there in \$$\frac{1}{3}$$? \$$\frac{2}{3}$$? \$$\frac{1}{6}$$? \$$\frac{5}{6}$$?

17. How many cents are there in \$$\frac{1}{8}$$? \$$\frac{3}{8}$$? \$$\frac{5}{8}$$? \$$\frac{7}{8}$$?

18. What part of \$1 is 50 ¢ ? 25 ¢ ? 75 ¢ ? 20 ¢ ? 10 ¢ ?

19. What part of \$1 is $12\frac{1}{2}$ ¢ ? $87\frac{1}{2}$ ¢ ? $62\frac{1}{2}$ ¢ ? $37\frac{1}{2}$ ¢ ?

20. What part of \$1 is $33\frac{1}{3}$ ¢ ? $16\frac{2}{3}$ ¢ ? $8\frac{1}{3}$ ¢ ? $66\frac{2}{3}$ ¢ ?

21. Name all the different pieces of money you can think of that are made of silver; of copper and nickel; of gold.

22. Name all the different denominations of paper money you can think of.

Find the values of the following in cents, and add or subtract as indicated :

23. \$$\frac{1}{2}$$ + \$$\frac{1}{3}$$.
24. \$$\frac{1}{4}$$ + \$$\frac{1}{3}$$.
25. \$$\frac{1}{4}$$ + \$$\frac{1}{10}$$.
26. \$$\frac{3}{4}$$ + \$$\frac{1}{5}$$.
27. \$$\frac{2}{3}$$ + \$$\frac{3}{10}$$.
28. \$$\frac{1}{2}$$ + \$$\frac{1}{3}$$.
29. \$$\frac{1}{2}$$ + \$$\frac{3}{4}$$.
30. \$$\frac{3}{4}$$ − \$$\frac{1}{5}$$.
31. \$$\frac{2}{3}$$ − \$$\frac{1}{4}$$.
32. \$$\frac{3}{10}$$ − \$$\frac{1}{20}$$.
33. \$$\frac{1}{2}$$ − \$$\frac{1}{20}$$.
34. \$$\frac{4}{5}$$ − \$$\frac{7}{10}$$.

How many cents are there in each of the following :

35. $\frac{1}{2}$ of $\frac{1}{2}$ of \$1 ?
36. $\frac{1}{2}$ of $\frac{1}{4}$ of \$1 ?
37. $\frac{1}{2}$ of $\frac{1}{10}$ of \$1 ?
38. $\frac{1}{5}$ of $\frac{1}{2}$ of \$1 ?
39. $\frac{1}{5}$ of $\frac{3}{10}$ of \$1 ?
40. $\frac{3}{4}$ of $\frac{1}{5}$ of \$1 ?
41. $\frac{1}{8}$ of $\frac{3}{4}$ of \$1 ?
42. $\frac{1}{3}$ of $\frac{6}{10}$ of \$1 ?
43. $\frac{3}{4}$ of $\frac{3}{4}$ of \$1 ?

82. 44. How many cents will be left, if you have half a dollar, spend a dime and a half dime and lose 34 ¢ ?

How many cents will be left —

45. If you have 2 fifths of a dollar, and spend 1 eighth of your money ?

46. If you have 63 ¢, and lose 2 quarters of a dollar ?

47. If you have 9 dimes, a 5-cent piece, and 7 cents, and spend 3 quarters of a dollar ?

48. If you have half a dollar and six 10-cent pieces, and buy with your money a dozen candles at 7 ¢ apiece and a lamp for 18 ¢ ?

49. Add the values of any 4 different pieces of silver money, buy with the sum 3 pounds of sugar at 9 ¢ a pound, and 1 pint of milk at 8 ¢ a quart. How much money have you left ?

50. Buy a hat for 62 ¢, some paper for 12 ¢, 2 pencils at 4 ¢ apiece, some rubber at 6 ¢, and give $1 in payment. What change should you receive back ?

51. Luther has 4 fifths of a dollar, and Charles has 2 dimes. How much money must Luther give to Charles that they may have equal sums ?

52. Having 69 ¢, buy as many blank books at 15 ¢ apiece as possible, and spend the rest of your money for paper at the rate of 5 sheets for 3 cents. How many blank books and how many sheets of paper will you buy ?

53. Myra had 9 tenths of a dollar, and spent 28 ¢ for a book, 25 ¢ for a knife, and 7 ¢ for a string. The money she had left was in 2 pieces ; what must have been the value of each piece ?

54. Clara had $1.25, and bought 3 yards of cambric at 12 ¢ a yard, some buttons for 18 ¢, some silk for 10 ¢, and the merchant gave her the change in the smallest number of pieces possible. How much money did she receive back, and what was the value of each piece ?

55. Brett had 2 quarters of a dollar, two 10-cent pieces, six 3-cent pieces, and 11 single cents ; these he exchanged for the same value in the smallest number of pieces possible. What pieces did he receive in exchange ?

SECTION XXXIII.

ALIQUOT PARTS.

83. 1. What is one of the three equal parts of 10 ? one of the five equal parts ?

One of the equal parts of a number is an *aliquot part* of the number. Thus 3⅓ and 2 are both aliquot parts of 10.

2. What aliquot part of 10 is 2½ ?
3. Name some aliquot parts of 20 ; of 50.
4. Name some aliquot parts of 1 dollar. [See p. 104, Art. 81.]

To Multiply by an Aliquot Part.

84. 5. What is the cost of 24 strawberry plants at 3⅓ cents apiece ?

Solution. At 10 cents apiece, 24 plants would cost 240 cents. At 3⅓ cents, they would cost ⅓ of 240 cents, which is 80 cents.

Ans. 80 cents.

6. What is the cost of 36 pencils at 2½ cents each, and 24 at 5 cents each ?

To multiply

7. By 25, multiply by 100 and divide by what ?
8. By 12½, multiply by 100 and divide by what ?
9. By 33⅓, multiply by 100 and divide by what ?
10. By 16⅔, multiply by 100 and divide by what ?
11. By 125, multiply by 1000 and divide by what ?

12. Multiply 18 by 16⅔.

Solution. 18 multiplied by 100 is 1800 (18 hundred) ; 18 multiplied by 16⅔, which is ⅙ of 100, must be ⅙ of 1800, which is 300.

Ans. 300.

13. Multiply 36 by 16⅔. | **15.** Multiply 15 by 33⅓.
14. Multiply 48 by 25. | **16.** Multiply 56 by 12½.

Note. — In some cases it will be more convenient to find first the aliquot part of the number to be multiplied, and then multiply. Thus, to multiply 18 by 16⅔, first find ⅙ of 18, which is 3, and multiply this result by 100, which gives 300, as above.

17. What is the cost of 24 straw hats at 12½ ¢ each ?

18. Find what 27 pounds of honey come to at 33⅓ ¢ a pound; at 50 ¢ a pound.

19. Find the cost of 8 bushels of turnips at 25 ¢ a bushel; at 75 ¢ a bushel.

20. Mr. Smith is paid for work at the rate of 37½ ¢ an hour. How much is he paid for 16 hours' work ?

Note. — First find the amount paid at 12½ ¢ an hour, then multiply by 3 to find the amount at 37½ ¢ an hour.

21. What must be paid for 200 turkeys at 75 ¢ apiece ?
22. What is the cost of 24 pear trees at 87½ ¢ apiece?
23. What can a girl earn in 6 days at 66⅔ ¢ a day ?
24. What is the cost of 12 peach trees at 62½ ¢ each ?
25. What is the cost of 8 dozen slates at 6¼ cents each ?

To Divide by an Aliquot Part.

85. **26.** How many bananas at 3⅓ cents can be bought for 40 cents ?

Solution. At 10 cents each, 4 bananas can be bought for 40 cents. At 3⅓ cents, which is ⅓ of 10 cents, 3 times 4, which is 12 bananas, can be bought for 40 cents. *Ans.* 12 bananas.

27. Divide 150 by 3⅓. Divide 70 by 2½.
28. To divide by 16⅔, divide by 100 and multiply by what ?

29. Divide 700 by 16⅔. | **31.** Divide 1200 by 33⅓.
30. Divide 300 by 25. | **32.** Divide 600 by 12½.

33. How many yards of calico at 12½ cents per yard can be bought for $1 ? for $1.50 ?

SECTION XXXIV.

MEASURES OF TIME.

86. Repeat the following table:

60 seconds (s.)	=	1 minute, m
60 minutes	=	1 hour, h.
24 hours	=	1 day, d.
7 days	=	1 week, w.
52 weeks and 1 day, or 365 days,	=	1 year, y.
100 years	=	1 century, c.

1. How many seconds are there in each of the following fractions of a minute?

$$\tfrac{1}{2}, \ \tfrac{1}{3}, \ \tfrac{2}{3}, \ \tfrac{3}{4}, \ \tfrac{2}{5}, \ \tfrac{3}{5}, \ \tfrac{4}{5}, \ \tfrac{5}{6}, \ \tfrac{6}{12}, \ \tfrac{7}{12}, \ \tfrac{4}{15}.$$

How many minutes are there in each of the following?

2. $\frac{1}{2}$ hour + $\frac{1}{3}$ hour.

3. $\frac{1}{5}$ hour + $\frac{1}{6}$ hour.

4. $\frac{1}{2}$ hour − $\frac{1}{3}$ hour.

5. $\frac{3}{4}$ hour − $\frac{2}{3}$ hour.

"Thirty days hath September,
April, June, and November;
All the rest have thirty-one,
Except the second month alone,
To which we twenty-eight assign,
Till leap-year gives it twenty-nine."

87. The year is divided into 12 months, as illustrated in the preceding diagram.

6. Name the months that have 30 days each.

7. Name the months that have 31 days each.

8. How many days has February?

NOTE. — Until the year 1900, any year the number of which is divisible by 4, is a leap-year.

What part of 2 months, or 60 days, is

9. 30 days ?	12. 20 days ?	15. 6 days ?	18. 3 days ?
10. 15 days ?	13. 10 days ?	16. 5 days ?	19. 1 day ?
11. 45 days ?	14. 40 days ?	17. 4 days ?	20. 12 days ?

21. How many months are there in 1 year? in 1 year 8 months? in 2 years 1 month? in 8 years 4 months?

What part of 200 months (16 years 8 months) is

22. 8 years 4 months ?	25. 3 years 4 months ?
23. 4 years 2 months ?	26. 1 year 8 months ?
24. 2 years 1 month ?	27. 12 years 6 months ?

How many months

28. From Jan. 1 to July 1 ?	31. From Feb. 1 to May 1 ?
29. From April 1 to Oct. 1 ?	32. From Aug. 1 to Oct. 1 ?
30. From July 1 to Jan. 1 ?	33. From Mar. 1 to Jan. 1 ?

How many days are there

34. From Apr. 1 to July 1 ?	39. From Nov. 9 to Dec. 12 ?
35. From July 1 to Oct. 1 ?	40. From Jan. 17 to Feb. 1 ?
36. From Oct. 1 to Jan. 1 ?	41. From Mar. 20 to Apr. 3 ?
37. From Jan. 1 to Feb. 5 ?	42. From June 27 to July 4 ?
38. From Mar. 7 to Apr. 19?	43. From Sept. 20 to Oct. 12 ?

44. Sarah spent the time from July 3 to Oct. 8 at her aunt's. How many days was she there?

45. Horace left home Jan. 27, 1884, and returned March 5. How many days was he absent?

SECTION XXXV.

MEASURES OF WEIGHT.

88. Repeat the following table:

AVOIRDUPOIS WEIGHT.

16 ounces (oz.) = 1 pound, lb.
2000 pounds   = 1 Ton, T.

NOTE. — Avoirdupois weight is used for weighing groceries and other common articles.

1. How many ounces are there in 2 lbs. ? in 3 lbs. 5 oz. ?

2. How many ounces are there in ½ lb. ? in ¾ lb. ? in ¼ lb. ? in ⅝ lb. ?

3. Change to pounds and ounces, 20 oz. ; 40 oz. ; 50 oz.

4. What part of a pound is 8 oz. ? 4 oz. ? 2 oz. ? 12 oz. ?

5. How many pounds are there in half a ton ? in a quarter of a ton ?

6. If 100 pounds of flour cost $6 what is the cost of 1 lb. ? of 50 lbs. ? of 25 lbs. ?

7. What is the cost of 1 lb. 4 oz. of beef at 28 ¢ a pound ?

8. Charles went to market with 89¢ in change. After buying 5 lbs. 12 oz. of squash at 4 ¢ a pound, and 4 lbs. 7 oz. tongue at 16 ¢ a pound, he attempted to pay for his purchases. How much more money did he require ?

9. What part of a ton is 1000 pounds ? 1500 pounds ?

10. At $7.00 a ton what is the cost of 500 lbs. of coal ? of 750 lbs. ?

11. At $24 a ton what is the cost of 300 lbs. of hay ?

12. At 2½ cents a pound what is the cost of 1 ton of salt ? of 3 tons ?

13. A barrel of flour contains 196 lbs. How many pounds *does a half* barrel of flour contain ?

14. A housekeeper roasted a piece of beef 2 hours and 10 minutes, allowing 15 minutes to a pound. How many pounds and ounces did the beef weigh ?

15. If coal is worth $8 a ton, what is the expense of a coal fire for the month of April, allowing the fire to consume 25 lbs. per day ?

NOTE. — In weighing some articles, as iron and coal at the mines, and goods on which duties are paid at the United States custom houses, the long ton of 2240 pounds is used. In this weight

         28 pounds (lbs.)   = 1 quarter, qr.
          4 quarters   = 1 hundredweight, cwt.
         20 hundredweight   = 1 Ton, T.

16. How many more pounds in a long ton than in a common ton ?

89. Repeat the following table :

TROY WEIGHT.

         24 grains (gr.)   = 1 pennyweight, pwt.
         20 pennyweights   = 1 ounce, . . . oz.
         12 ounces   = 1 pound, . . lb.

NOTE. — Troy weight is used for weighing gold, silver, precious stones, and other articles that require great accuracy in weighing.

17. How many grains in 1 pwt. ? in 2 pwt. 5 gr. ?

18. What part of an oz. is 10 pwt. ? 5 pwt. ? 4 pwt. ?

19. What part of a pwt. is 8 gr. ? 4 gr. ? 6 gr. ? 3 gr. ?

20. How many pounds in 25 oz. ? in 30 oz. ?

21. If a quantity of gold weighed 4 lb. 10 oz. before refining, and 3 lb. 11 oz. afterwards, how much was lost in the process ?

22. What is the value of ¼ lb. of gold at $16 an ounce ?

23. How many silver thimbles of 4 pwt. each can be made from 3 oz. of silver ?

SECTION XXXVI.

MEASURES OF LENGTH, AREA, AND VOLUME.

90. Repeat the following table :

LONG MEASURE.

$$
\begin{aligned}
12 \text{ inches (in.)} &= 1 \text{ foot, ft.} \\
3 \text{ feet} &= 1 \text{ yard, yd.} \\
\left.\begin{array}{l} 5\tfrac{1}{2} \text{ yards, or} \\ 16\tfrac{1}{2} \text{ feet} \end{array}\right\} &= 1 \text{ rod, rd.} \\
\left.\begin{array}{l} 320 \text{ rods, or} \\ 5280 \text{ feet} \end{array}\right\} &= 1 \text{ mile, m.}
\end{aligned}
$$

1. How many inches are there in 1 yard? in $\frac{1}{2}$ yd.? in $\frac{1}{4}$ yd.? in $\frac{3}{4}$ yd.? in $\frac{1}{3}$ yd.? in $\frac{1}{6}$ yd.?

2. What part of a foot is 6 inches? 4 in.? 8 in.? 3 in.? 9 in.? 2 in.? 10 in.?

3. How many half yards are there in 1 rod?

4. How many half feet are there in 1 rod?

5. How many rods are there in 1 mile? in $\frac{1}{2}$ m.? in $\frac{1}{4}$ m.? in $\frac{1}{8}$ m.?

6. After you have walked 5,000 feet, how much farther must you walk to go a mile?

Exercises.

a. Draw upon your slate or blackboard a line that you think is 1 inch long. Draw one that you think 4 inches long; 6 inches long; 1 foot long.

b. Mark off in some convenient place a distance of 3 feet; a distance of 6 feet; of 5 feet.

c. Measure a rod upon the ground, and count your steps in walking that distance.

NOTE. — If you remember the number of steps you usually take in walking a rod, you will have a convenient measure always with you.

d. By walking and counting your steps, estimate the length of the school yard; the width of the street; the distance to your home, etc.

MEASURES OF AREA.

91. A *rectangle* is any four-sided figure which has all its corners square.
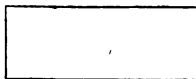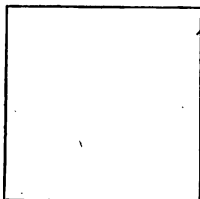
A Rectangle.

A *square* is a four-sided figure which has its corners square and its sides equal.

A square each of whose sides is one inch long is a *square inch*. A square each of whose sides is one foot long is a *square foot*.

A Square.

To find the Area of a Rectangle.

The *area* of any surface is its contents reckoned in square units.

7. If a rectangle is 4 inches long and 1 inch wide, how many square inches does it contain? How many does it contain if it is 4 inches long and 2 inches wide? 4 inches long and 3 inches wide?

8. What numbers will you multiply together to find the area of any rectangle?
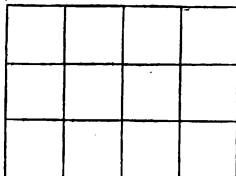
The area of a rectangle is found by *multiplying the number of units in the length, by the number of like units in the breadth.* This is expressed for brevity as *multiplying the length by the breadth.*

9. How many inches long is a square foot? How many inches wide? Then how many square inches are there in a square foot?

10. How many feet long is a square yard? How many feet wide? Then how many square feet are there in a square yard?

92. Repeat the following table:

SQUARE MEASURE.

144 square inches	= 1 square foot, sq. ft.
9 square feet	= 1 square yard, sq. yd.
30¼ square yards, or } 272¼ square feet	= 1 square rod, sq. rd.
160 square rods	= 1 acre, . . . A.
640 acres	= 1 square mile, sq. m.

11. How many square inches are there in a board 6 in. long and 4 in. wide? 8 in. long and 7 in. wide?

12. How long must a piece of cloth 1 yard wide be to contain 2 square yards? 5 square yards?

13. How many square yards of surface can be covered by 4 yards of carpeting that is 1 yard wide? How much by 4 yards that is 3 fourths of a yard wide? that is one half of a yard wide?

14. How many square yards can be covered by 5 yards of canvas that is 2 yards wide? By 12 yards that is 1 yard and a half wide?

15. How many square feet are there in a mat that is 8 feet long and 6 feet wide? How many square yards are there in the mat?

16. If a mat is 6 feet long, how wide must it be to contain 24 square feet?

17. How much will a mat cost that is 6 feet long and 4 *feet* wide, at a quarter of a dollar a square foot?

18. Mrs. Webster has a hall 15 feet long and 9 feet wide, which she wishes to cover with carpet a yard wide. How many yards must she buy ?

19. In the floor of a room 12 feet square are how many square yards ?

NOTE. — 1 square foot and 1 foot square name equal areas. But 12 feet square names a square 12 feet long and 12 feet wide, and which contains 144 square feet.

20. What is the difference between 2 inches square and 2 square inches ? between 3 feet square and 3 square feet ?

21. Mr. Blake had a grass-plot 12 yards square, from which he cut off 20 square yards for a flower-bed. How many square yards were left ?

22. In a strip of board 5 feet long and 1 inch wide are how many square inches ?

23. In a piece of board 2 feet long and 4 inches wide are how many square inches ? How wide must the board be to contain 1 square foot ?

93. Mark off in some convenient place a square that is 1 rod long and 1 rod wide ; what will you call this square ? 160 such squares make 1 acre, used in measuring land.

24. How many square rods are there in 1 half of an acre ? in 1 quarter of an acre ? in 1 eighth of an acre ?

25. Mr. Armes laid out an acre of land in 5 equal house-lots. How many square rods were there in each lot ?

26. Mr. Green had a piece of land 80 rods long and 6 rods wide, $\frac{1}{10}$ of which he sold to Mr. Allen for a house-lot. How many square rods were there in Mr. Allen's house-lot ?

27. If a piece of land is 16 rods long, how wide must it be to contain an acre ?

28. How many farms of 10 acres each can be made from 1 square mile of land ? How many farms of 64 acres each ?

29. How many square feet of sodding will be required for a lawn 3 rods long and 10 feet wide ?

MEASURES OF VOLUME.

94. A solid body is a body having length, breadth (or width), and thickness (height or depth).

A *rectangular solid* is a solid bounded by six rectangles.

A brick is a rectangular solid body.

A *cube* is a solid bounded by six equal squares.

A cube each of whose edges is one inch long is a cubic inch. A cube each of whose edges is one foot long is a cubic foot, etc.

A Cube.

To find the Volume of a Rectangular Solid.

The volume of a solid is its contents reckoned in cubic units.

30. If a rectangular solid is 4 inches long and 2 inches wide, how many square inches does its base contain? If it is 1 inch thick, how many cubic inches does it contain? If it is 3 inches thick, how many cubic inches does it contain?

31. What numbers are multiplied together to find the volume of the rectangular solid 8 inches long, 2 inches wide, and 3 inches thick?

The volume of any rectangular solid may be found by *multiplying the number of units in the length by the number of like units in the breadth, and this product by the number of like units in the thickness.* This is expressed for brevity as *multiplying the length, breadth, and thickness together.*

32. How many cubic inches in a rectangular solid 12 inches long, 12 inches wide, and 1 inch high? If this rectangular solid were 12 inches high instead of 1, how many cubic inches would it contain? 12 times 144 are 1728.

33. *How* many cubic inches make a cubic foot?

34. How many cubic feet in a cube 3 feet long, 3 feet wide, and 3 feet thick ? Then how many cubic feet in a cubic yard ?

95. Repeat the following table :

CUBIC MEASURE.

1728 cubic inches (cu. in.) = 1 cubic foot, cu. ft.
27 cubic feet   = 1 cubic yard, cu. yd.
128 cubic feet   = 1 cord, cd.

NOTE. — The cord is used in measuring fire-wood.

Wood is generally cut for the market into sticks four feet long, and laid in piles, so that the length of the sticks becomes the width of the pile. A pile 4 feet wide, 4 feet high, and 8 feet long contains 1 cord.

One eighth of a cord is called a *cord foot.* A cord foot contains 16 cubic feet. (See picture above.)

35. How many cubic feet in a block 3 feet long, 1 foot wide, and 2 feet high ?

36. How many cubic inches does a box contain that measures inside 6 inches in length, 3 inches in width, and 4 inches in depth ?

37. How much space will contain a box that measures outside 4½ feet in length, 4 in breadth, and 3 in height ?

38. How many square inches in the surface of a cubical block whose edges are 3 inches long ?

39. How many cords of wood in a pile 4 feet wide, 4 feet high, and 16 feet long ? 20 ft. long ? 32 ft. long ? How many cord feet in 1 cd. 7 cd. feet ?

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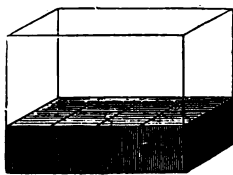
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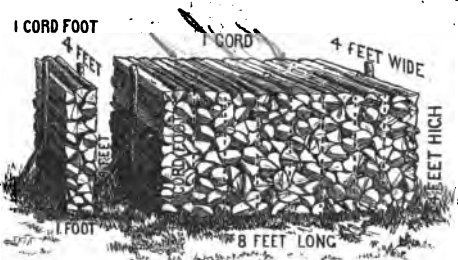
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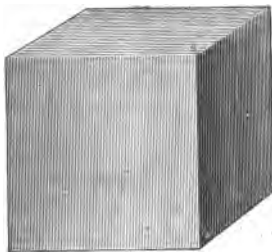
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26. Bought $3\frac{1}{8}$ pounds of beef at 18 cents a pound. How much did it cost?

27. If $5\frac{1}{4}$ dozen eggs cost 1\frac{1}{2}$, what is the price per dozen?

28. If a cooper can set up barrels at the rate of 1 in $\frac{3}{10}$ of an hour, how many can he set up in 6 hours?

29. If $\frac{2}{3}$ of a box of raisins is worth $4, how many clocks at $2 apiece will pay for a box of raisins?

30. A rectangular garden is 98 feet long and 62 feet wide, and there is but $\frac{5}{8}$ enough fencing to enclose it. How many more feet of fencing is needed?

31. If a pound of wool is required to make $1\frac{1}{8}$ yards of cloth, how many pounds of wool will be required to make $1\frac{1}{4}$ yards of the same kind?

32. Ten dozen hats were bought at $6\frac{1}{2}$ a dozen; 8 dozen of these were sold at $1 per hat, and the rest at $\frac{1}{4}$ a hat. Was there a gain or a loss on the lot, and how much?

33. If a vine grows at the rate of $\frac{1}{20}$ of an inch in 10 minutes, in what time will it grow a yard?

34. If it begins to snow at a quarter past 9, and snows at the rate of $\frac{1}{6}$ of an inch in a minute, at what time will the snow be a foot deep?

35. Austin's age is $12\frac{1}{6}$ years; Mary's, $13\frac{1}{3}$ years; Alvin's, $13\frac{5}{12}$ years; and John's, $14\frac{1}{4}$ years. What is the sum of their ages? What is their average age?

36. Austin weighs $98\frac{1}{2}$ pounds; Mary, $101\frac{1}{2}$ pounds; and Alvin, $100\frac{5}{8}$ pounds. What is the sum of their weights? What is their average weight?

37. A meter equals $39\frac{3}{8}$ inches. How many yards in a meter, and what remains?

38. Mrs. Lyon bought 12 meters of silk for a dress. How many yards did she buy?

39. Otis received 18\frac{2}{3}$ for work; and after paying a debt of 12\frac{5}{12}$, he found that he had just money enough to pay for his board for $1\frac{1}{2}$ weeks. What was the price of his board for a week?

40. What part of the dial-plate does the hour-hand pass over between 12 o'clock and quarter past 3 ?

41. What part of the dial-plate does the hour-hand pass over between 1 o'clock and half past 6 ?

42. Mr. Jenks sold 2½ bushels of corn at $⅔ a bushel, and received his pay in muslin at $⅞ a yard. How many yards of muslin did he receive ?

43. A can dig a trench in 6 days, and B in 5 days. What part of the trench can each dig in one day ? What part can both dig in one day ? In how many days can both dig it, working together ?

44. Thomas and Richard together can shovel a path in 2 hours ; Thomas can shovel it in 3 hours. What part of it can both together do in 1 hour ? What part can Thomas do in 1 hour ? What part can Richard do in 1 hour ? In what time can Richard shovel it alone ?

45. James, John, and Charles can saw a pile of wood in 4 hours ; John and Charles can saw it in 6½ hours. What part of it can James alone saw in 1 hour ? In how many hours can James alone saw it ?

46. After X has lost ⅓ of his money, and Y has gained a sum equal to ⅓ of his, each has 63 dollars. How much had each at first ?

47. If a tailor sold a coat for $25, and gained ¼ of what it cost, what did it cost ?

48. A butcher has a cow and a calf, both of which he values at $30; estimating the value of the calf at ⅕ of the value of the cow, what is the value of each ?

49. If a hat and vest together cost $8, and the hat costs ⅓ as much as the vest, what is the cost of each ?

50. When 1 ton of coal is worth $9, and ⅔ of a ton of coal will pay for ¾ of a load of wood, how many pairs of boots, at $2 a pair, will pay for a load of wood ?

51. If I receive 25 cents for a hat by selling it at ⅘ of its cost, what should I have received by selling it at ⅞ of its cost ?

52. How many yards of canvas ½ yard wide will be required to make a screen 16½ feet long and 9 feet wide, allowing nothing for waste ?

53. How many tiles 4 inches square will cover 20 square feet ?

54. One bushel and 1 peck of oats were sown in a certain field. If 1½ pints were sown to a square rod, how many rods did the field contain ?

55. What was my ice bill for the month of February, 1883, if I took 80 pounds a week and paid 30 cents a hundred ?

56. My cook book says, " In roasting turkeys, allow an hour and three quarters for a turkey weighing 8 pounds, and for every additional pound allow 10 minutes more." I have a turkey which weighs 15 pounds 8 ounces ; how much time must I allow for roasting it ?

57. Four posts stand 11 feet apart in a straight line ; how many rods would a boy run in going from one end of the row to the other and back again ?

58. Two boys disputing about the distance from their home to the depot, settled the dispute by tying a string to a spoke in the wheel of a wheelbarrow and trundling it to the depot and counting the number of times the wheel turned, which was 200. If the circumference of the wheel was 3⅐ times the diameter and that was 1¾ feet, how far did the boys live from the depot ?

59. A certain room contains 60 cubic yards : if its length is 5 yards, and its width 4 yards, what is its height in feet ?

60. What is the cost of a pile of wood 1 rod long, 4 feet wide, and 4 feet high, at $8 dollars a cord ?

61. How many square feet of glass in 4 windows of 4 panes each, the panes being 3 feet long and 15 inches wide ?

62. At $2 a rod, what is the cost of fencing to enclose and separate 3 rectangular lots of land lying side by side and having their fronts in the same straight line; the width of the fronts being 4 rods and the length of the sides 6 rods each ?

SECTION XXXVIII.

PERCENTAGE.

97. 1. What is $\frac{1}{100}$ of 500 bushels ?

2. What is $\frac{3}{100}$ of 200 sheep ?

3. What is $\frac{5}{100}$ of 700 dollars ?

4. What is $\frac{2}{100}$ of 400 dollars ?

Any number of **hundredths** of a thing is a **per cent** of that thing ; and the above questions may be asked as follows :

5. What is one per cent of 500 bushels ?

6. What is three per cent of 200 sheep ?

7. What is five per cent of 700 dollars ?

8. What is two per cent of 400 dollars ?

The sign % is used for the words **per cent.**

What is

9. 3 % of 300 dollars ?

10. 10 % of 800 pounds ?

11. 6 % of 900 cattle ?

12. $2\frac{1}{2}$ % of 600 gallons ?

13. 1 % of 1000 ?

14. $\frac{1}{2}$ %* of 450 ?

15. $7\frac{1}{2}$ % of 2000 ?

16. $3\frac{1}{2}$ % of 4000 ?

17. The whole of a thing equals what per cent of it ?

18. One half of a thing equals what per cent of it ?

19. What per cent of a thing is $\frac{1}{4}$ of it ? $\frac{3}{4}$ of it ?

20. What per cent of a thing is $\frac{1}{3}$ of it ? $\frac{2}{3}$ of it ?

21. What per cent of a thing is $\frac{1}{5}$ of it ? $\frac{2}{5}$ of it ?

22. What per cent of a thing is $\frac{3}{10}$ of it ? $\frac{7}{10}$ of it ?

23. What per cent of a thing is $\frac{1}{8}$ of it ? $\frac{3}{8}$ of it ?

24. What per cent of a thing is $\frac{1}{20}$ of it ? $\frac{7}{20}$ of it ?

25. What per cent of a thing is $\frac{1}{25}$ of it ? $\frac{6}{25}$ of it ?

* Read " one half of one per cent."

26. What fraction of a thing is 50 % of it ? 25 % of it ?
27. What fraction of a thing is 33⅓ % of it ? 66⅔ % of it ?
28. What fraction of a thing is 10 % of it ? 30 % of it ?
29. What fraction of a thing is 12½ % of it ? 62½ % of it ?

98. Change the following fractions to per cents :

	i.	ii.	iii.	iv.	v.	vi.	vii.	viii.
a.	½	1/10	3/8	7/10	7/16	3/25	1/30	3/50
b.	⅕	¼	⅔	3/8	1/20	1/40	2/25	7/10
c.	⅛	⅔	3/10	5/6	1/25	17/20	5/6	7/15
d.	⅙	¾	⅞	1/12	3/20	4/25	3/40	1/60
e.	⅓	⅘	9/10	5/8	2/25	13/20	1/80	1/90

Change the following per cents to common fractions :

	i.	ii.	iii.	iv.	v.	vi.	vii.	viii.
f.	25 %	33⅓ %	40 %	37½ %	6¼ %	1½ %	85 %	12 %
g.	10 %	12½ %	80 %	83⅓ %	2½ %	8 %	1¾ %	15 %
h.	50 %	66⅔ %	60 %	87½ %	3½ %	2 %	95 %	6 %
j.	20 %	16⅔ %	30 %	8⅓ %	7½ %	5 %	1⅞ %	16 %
k.	75 %	62½ %	70 %	90 %	1¼ %	4 %	96 %	1⅕ %

99. 30. In a town of 5200 inhabitants, **25 % are Germans;** how many are Germans ?

NOTE. — 25 % = ¼ ; ¼ of 5200 equals 1300.

31. A trader bought iron at 6 ¢ a pound, and sold it so as to gain 33⅓ % ; for what price did he sell it ?
32. A school girl spelled 240 words, and 5 % of them were wrong ; how many were wrong ?
33. A grocer paid 56 ¢ a pound for tea; for what must he sell it to gain 37½ % ?
34. The price of hay is now $20 a ton; if the price should advance 30 %, what would it be ?
35. A broker charges ¼ % for investing money in stocks; how much would he receive for investing $5000 ?

36. When ½ % is paid for collecting the taxes of a town, what sum is paid for collecting $8000 ?

37. A man pays 8 % a year for the use of borrowed money; how much must he pay for the use of $10,000 for one year ?

38. An auctioneer charges 10 % for selling goods; how much will he receive for sales amounting to $840 ?

39. The school week consists of 5 days of 5 hours each, and 25 % of the time is given to arithmetic; how many hours a week are given to arithmetic ?

40. At an examination for promotion 560 pupils were examined, and 90 % of them passed; how many pupils passed ?

41. A gardener planted 960 trees, and 87½ % of them lived; how many trees lived ?

42. A man bought land at $150 an acre, and sold it for 80 % of its cost; for how much did he sell it ?

43. The taxes on real estate in a certain city are at the rate of 1¼ % on the valuation; what tax must be paid on an estate valued at $20,000 ?

44. A landlord has raised the rent of his tenements 8⅓ %; what is now paid for a tenement which was formerly rented for $36 ?

45. A trader paid 40 ¢ a yard for some cloth; if he sells it so as to gain 100 %, what does he get for it ?

46. What is 100 % of $15 ?

47. A man made a fortunate investment, gaining 250 %; if he invested $6000, what was the amount of his gain ?

48. What is 200 % of 35 pounds ?

49. What is 150 % of 16 cents ?

50. What is 175 % of 40 miles ?

51. A speculator sold some land which cost him $1500 so as to gain 166⅔ %; for how much did he sell it ?

52. Some young cattle were put into a pasture for the summer, and while there increased 120 % in weight; if their average weight was 150 pounds when turned out, what was their average weight when they came home ?

100. 53. Two men are to share the earnings of a certain factory; if 40 % goes to one man, what per cent goes to the other ?

The *complement* of any per cent is the difference between that per cent and 100 per cent. Thus the complement of 40 per cent is 60 per cent, and the complement of 85 per cent is 15 per cent.

54. What is the complement of 20 % ? of 50 % ? of 75 % ?

55. What is the complement of 35 % ? of 95 % ? of 56 % ?

56. What is the complement of $33\frac{1}{3}$ % ? of $62\frac{1}{2}$ % ? of $83\frac{1}{3}$ % ?

57. From a cask containing 20 gallons of wine, 20 % leaked out; what per cent remained in the cask ? how many gallons ?

58. The creditors of a certain bankrupt receive 45 % of their claims; what per cent do they lose ? What does one creditor lose who has a claim for $2000 ?

59. In a certain town 21 % of the people are Canadians, 32 % are Irish, 17 % are Germans, and the rest are native Americans; what per cent are native Americans ?

60. Of the price paid in the city for milk, 20 % goes to the milkman, 35 % to the wholesale dealer, $7\frac{1}{2}$ % to the country agents and the railroad; the rest goes to the farmer; what per cent goes to the farmer ?

101. 61. A man bought a cow for $40, and sold her for $50. What per cent did he gain ?

Solution. He gained the difference between $40 and $50, or $10. A gain of $10 on $40 is a gain of $\frac{10}{40}$, or $\frac{1}{4}$, which equals 25 %.

NOTE. The gain or loss is always reckoned as a fraction or a per cent of the cost.

62. A man bought a horse for $160 and sold it for $120. What per cent did he lose ?

63. From a drove of 1000 sheep, 80 were lost by accidents. What per cent were lost ?

64. Out of a cargo of 6000 bushels of potatoes, 300 bushels were not marketable. What per cent were marketable ?

65. Coffee bought for 25 ¢ is sold for 30 ¢ a pound. What per cent is gained ? ' Henry's boat cost $24, and he sold it at a loss of $4. What per cent did he lose ?

66. A piece of land that cost 15 cents a square foot was sold at a loss of 6 cents a square foot. What per cent was lost ? The person to whom the land was sold, sold it again for 15 ¢ a square foot. What per cent did he gain ?

67. A trader finds that he has $3 for every $5 he owes. What per cent of his debts can he pay ?

68. Thomas fails on 3 examples out of 20 in his arithmetic. What per cent of his work is correct ?

69. Sallie spells 19 words out of 25 correctly. What per cent does she spell correctly ?

70. A dealer bought 250 barrels of flour; he lost 20 % of it, and sold 25 % of the remainder. What per cent of the whole remained ?

71. A miller takes for toll 3 quarts out of every bushel of wheat he grinds. What per cent does he take ?

72. What per cent of 400 gallons is 32 gallons ? of 500 dozen is 60 dozen ?

73. What per cent of 1200 is 800 ? of 150 is 90 ? of 240 is 210 ?

74. What per cent of $\frac{1}{3}$ is $\frac{1}{6}$? of $\frac{1}{2}$ is $\frac{1}{8}$? of $\frac{1}{2}$ is $\frac{3}{8}$?

75. What per cent of $\frac{1}{2}$ is $\frac{3}{10}$? of $\frac{2}{3}$ is $\frac{5}{12}$?

76. A farmer sold a lot of cows, receiving for every four cows as much as five cows cost him. What per cent did he gain ?

77. A dealer buys coal by the long ton (2240 lbs.) and sells by the short ton (2000 lbs.). If his price per ton is the same in buying as in selling, what per cent does he gain ?

78. The price of glass tumblers being $1.20 per dozen, what will the price be when they are 25 % cheaper ? when they are 40 % cheaper ?

79. A man by imprudent speculation lost 85 %.; if he invested $12,000, how much money remained to him ?

80. Owing to a fall in prices a shopkeeper is obliged to sell 10 yards of cloth for what 7 yards cost him. What per cent is he losing?

81. A sold to B cloth which cost A 60¢ a yard, at a loss of 60 %; what did B pay for it? B sells the cloth so as to gain 75 %; what does he get for it?

102. 82. A lawyer has a commission of 10 % for collecting a debt. If he receives $46 as commission, what was the debt collected?

83. 46 is 10 % of what number? [See page 170.]

84. An agent has a commission of 4 % for selling real estate. If he receives $500 for selling a farm, what is the price he received for the farm?

85. 500 is 4 % of what number?

86. A trader sold a horse for $18 more than it cost, thereby gaining 9 %. What did the horse cost?

87. A merchant failing in business pays 40 % of his debts. I have a claim upon him for which I shall receive $320. What is the amount of my claim?

88. By selling apples at $3.60 a barrel I lose 10 %. What did they cost me?

89. What must have been the cost of oranges which sell for $6.30 a box at a gain of 40 %?

90. A gain of 20 % is made by selling sugar at 12¢ per pound. For what must it be sold to make 30 %?

91. A man lost 60 % on a watch by selling it for $80. For how much should he have sold it to gain 60 %?

92. A carriage was sold for $460 at a loss of 8 %. What per cent would have been gained if it had been sold for $560?

93. Two wagons were sold for $150 each; on one there was a gain of 25 %, and to the other a loss of 25 %. Taking the two trades together, was there a gain or a loss? If either, how much, and what per cent?

94. A man buys railroad shares at 40 % below par value and sells them at 20 % above par value. What per cent does he gain ?

95. A man sold his watch for $ 90 thereby losing 40 %. With the $ 90 he bought another watch, and afterwards sold it so as to gain 40 %. How much did he lose by the two trades together ?

96. A money-lender received $ 24 for a month's interest on money at 1 % a month. What was the sum of money lent ?

97. A house is insured at 1¼ % premium. If the premium is $ 75 what is the amount insured on the house ?

98. In a town when the taxes are at the rate of 1⅗ % on the valuation, what is the valuation of an estate upon which the tax amounts to $ 84 ?

99. What is the valuation of an estate upon which the tax amounts to $ 700, the rate being 1¾ % ?

100. $ 3000 is 3 % of what sum of money ?

101. $ 1200 is 4 % of what sum of money ?

102. $ 750 is 2½ % of what sum of money ?

103. $ 650 is $1\frac{3}{10}$ % of what sum of money ?

104. If ½ of the price received for a thing is gain, what per cent is gained ?

105. If ⅓ of the price received for a thing is gain, what per cent is gained ?

106. What per cent is gained when ¼ of the price received for a thing is gain ? When ⅕ is gain ?

107. What per cent is gained when ⅙ of the selling price is gain ?

108. When ⅐ is gain ?	114. When 4/7 is gain ?
109. When ⅑ is gain ?	115. When 2/7 is gain ?
110. When 3/4 is gain ?	116. When 3/7 is gain ?
111. When 2/4 is gain ?	117. When 3/8 is gain ?
112. When ⅔ is gain ?	118. When 5/8 is gain ?
113. When ⅖ is gain ?	119. When 4/3 is gain ?

9

120. If the cost price is $\frac{3}{4}$ of the selling price what per cent is gained ?

121. If the cost of a thing is $\frac{2}{3}$ of the price it is sold for, what per cent is gained ?

122. What per cent is gained if the cost of a thing is $\frac{3}{4}$ of the selling price ?   If it is $\frac{4}{5}$?

123. What per cent is gained if the cost of a thing is $\frac{5}{6}$ of the selling price ?   If it is $\frac{4}{7}$? $\frac{5}{7}$?

124. What per cent is gained if the cost of a thing is $\frac{3}{8}$, $\frac{5}{8}$, $\frac{5}{9}$, of the price received ?

125. What per cent is gained if the cost of a thing is $\frac{5}{12}$, $\frac{7}{8}$, $\frac{9}{10}$, of the price received ?

What per cent is gained if each of the following per cents of the price received for a thing is gain ?

126. 33$\frac{1}{3}$ % ? | 128. 20 % ? | 130. 60 % ? | 132. 37$\frac{1}{2}$ % ?
127. 25 % ? | 129. 40 % ? | 131. 80 % ? | 133. 62$\frac{1}{2}$ % ?

134. What per cent is gained or lost when the cost is to the selling price as 2 to 3 ?

NOTE.   This means that the cost is $\frac{2}{3}$ of the selling price, or that the selling price is $\frac{3}{2}$ of the cost.   There is a gain in this case of $\frac{1}{2}$ or 50 % of the cost.

135. What per cent is gained or lost when the cost is to the selling price as 3 to 5 ? as 3 to 4 ? as 4 to 5 ?

136. What per cent is gained or lost when the cost is to the selling price as 3 to 2 ? as 3 to 1 ? as 5 to 3 ?

What per cent is gained or lost when the cost is to the selling price

137. As 5 to 6 ? | 141. As 8 to 11 ? | 145. As 9 to 8 ?
138. As 5 to 7 ? | 142. As 10 to 9 ? | 146. As 6 to 5 ?
139. As 4 to 3 ? | 143. As 8 to 5 ? | 147. As 8 to 7 ?
140. As 5 to 4 ? | 144. As 8 to 15 ? | 148. As 10 to 8 ?

SECTION XXXIX.

INTEREST.

103. Said A to B, " I need $500 to use for one year. Can you lend me the money, and if so at what rate ? " B replied that he would lend the money at 8 %.   A then gave B a note for $500, took the money, and, at the end of the year, paid it back to B with $40 more as interest.

Interest is money charged for the use of money.

The money for the use of which interest is paid is the *principal.*

The principal and interest added together make the *amount.*

The per cent paid for one year's use of the principal is the *rate per cent per annum,* generally called simply the *rate.*

In the above example, what is the principal ? the rate ? the interest ? the amount ?

The $40 interest was found by reckoning 8 % of $500.

1. Find the interest on $500 for 1 year at 6%; at 3%; at 7%; at 10%; at 5%.
2. Find the interest on $800 for 1 year at 8%; at 3%; at $4\frac{1}{2}$%; at 7%; at $5\frac{1}{2}$%.
3. Find the interest on $3000 for 1 year at 3%; at 5%; at 6%; $2\frac{1}{2}$%; at 7%.
4. Find the interest on $2500 for 1 year at 6%; at 5%; at 7%; at 3%; at 9%.
5. Find the interest on $350 for 1 year at 1%; at 4%; at 8%; at 5%; at 7%.
6. Find the interest on $325 for 1 year at 1%; at 3%; at 4%; at 8%; at 10%.

7. Find the interest on $275 for 1 year at 4%; at 2%; at 6%; at 5%; at 12%.

8. Find the interest on $50 for 1 year at 8%; at 5%; at 7%; at 6%; at 10%.

9. Find the interest on $15 for 1 year at 5%; at 4%; at 6%; at 10%; at 3½%.

10. Find the interest on $9 for 1 year at 1%; at 7%; at 4⅛%; at 12%; at 2½%.

11. At 6% and for one year find the interest on 100 dollars; on 1000 dollars.

12. At 6% and for 1 year find the interest on $300; on $4000; on $10,000.

13. What is the yearly income on $25,000, paying 3% interest?

14. What is the yearly income on $50,000, paying 4% interest?

104. 15. If the interest on a sum of money for 1 year is $40, what is the interest on the same sum for 2 years? for 5 years? for half a year, or 6 months? for 3 months? for 1 year 9 months?

In the following examples (16–21) first find the interest for 1 year, then for the required number of years or fraction of a year.

16. What is the interest on $500 at 8% for 3 years? for 2 years and 6 months? for 1 year and 3 months?

17. What is the interest on $600 at 6% for 2 years? for 1 year and 3 months? for 2 years and 4 months?

18. What is the interest on $24 at 5% for 3 years? for 1 year and 2 months? for 2 years and 10 months?

19. What is the interest on $750 at 4% for 1 year? for 1 month? for 5 months? for 2 years and 7 months?

20. What is the interest on $8 at 6% for 5 months? for 3 months? for 1 year and 11 months?

21. What is the interest on $60 at 7% for 8 months? for 2 years and 6 months? for 3 years and 4 months?

22. The interest on a sum of money for 1 month (30 days) being 72 cents, what is the interest for 15 days? for 10 days? for 20 days? for 5 days? for 3 days? for 1 day?

23. What is the interest on $6 at 8% for 1 month? for 15 days? for 10 days? for 20 days?

24. What is the interest on $400 at 9% for 1 month? for 5 days? for 25 days? for 3 days? for 1 day?

25. At 8%, what is the interest on $300 for 1 year 1 month and 15 days?

26. At 7%, what is the interest on $1200 for 2 years 1 month and 20 days?

27. What is the interest on $100 at 9% for 3 years 4 months 20 days?

28. What is the interest on $450 at 4% for 2 years 4 months and 7 days?

29. What is the interest on $1500 at 4% for 1 year 7 months and 6 days?

30. What is the interest on $900 at 4% for 8 months and 1 day?

31. What is the interest on $2000 at 3% for 1 month and 18 days?

105. 32. Find the amount of $200 on interest 2 years and 6 months at 7%.

33. Find the amount of $4500 at 8% for 1 year 1 month and 5 days.

34. Find the amount of $5 at 5% for 5 years.

35. Find the amount of $75 at 6% for 10 years.

36. A note for $300 was on interest at 8% from June 25 to October 10. What amount was due on the last day named?

37. A note for $1000 was on interest at 4½% from March 25, 1883, to April 25, 1884. What amount was then due?

38. A note for $900 was on interest at 8% from May 13, 1883, to July 8, 1884. What amount was then due?

39. A note for $250 was on interest at 6% from February 20, 1882, to May 8, 1883. What amount was due then?

40. Find the amount of $500 at 5% for 20 years.

41. Find the amount of $100 at 6% for 16 years and 8 months.

The 200-month Method of Computing Interest at six per cent.

NOTE. — In the following examples (42–72) the rate is 6% unless otherwise stated.

106. 42. If a sum of money gain interest equal to $\frac{8}{100}$ of itself in a year, in what part of a year will it gain interest equal to $\frac{1}{100}$ of itself? In how many months?

43. If a sum of money gain interest equal to $\frac{1}{100}$ of itself in 2 months, in how many months will it gain interest equal to $\frac{100}{100}$ of itself?

44. The interest for 200 months being equal to the principal, how may we find the interest for 100 months? for 50 months? for 20 months? for any aliquot parts of 200 months?

$$
\begin{aligned}
\text{NOTE.} \quad 200 \text{ mo.} &= 16 \text{ y. } 8 \text{ mo.} \\
100 \text{ mo.} &= 8 \text{ y. } 4 \text{ mo.} \\
66\tfrac{2}{3} \text{ mo.} &= 5 \text{ y. } 6 \text{ mo. } 20 \text{ d.} \\
50 \text{ mo.} &= 4 \text{ y. } 2 \text{ mo.} \\
40 \text{ mo.} &= 3 \text{ y. } 4 \text{ mo.} \\
33\tfrac{1}{3} \text{ mo.} &= 2 \text{ y. } 9 \text{ mo. } 10 \text{ d.} \\
25 \text{ mo.} &= 2 \text{ y. } 1 \text{ mo.} \\
20 \text{ mo.} &= 1 \text{ y. } 8 \text{ mo.}
\end{aligned}
$$

45. What is the interest on $75 for 200 months? for 20 months? for 33⅓ months?

46. What is the interest on $80 for 100 months? on $60 for 25 months? on $15 for 40 months?

47. What is the interest on $400 for 50 months? on $45 for 66⅔ months? on $32 for 25 months?

48. What is the interest on $50 for 40 months? for 8 months? for 24 months?

49. What is the interest on $170 for 20 months? for 4 months? for 16 months?

50. What is the interest on $96 for 25 months? for 12 months and 15 days? for 15 months?

51. What is the interest on $72 for 75 months? on $160 for 150 months? on $620 for 30 months?

52. Find the amount of $35 for 8 months; for 16 months; for 4 years 2 months.

53. Find the amount of $200 for 1 year 3 months; for 2 years 4 months; for 10 months.

54. The interest for 200 months being equal to the principal what part of the principal equals the interest for 2 months (or 60 days)?

55. If the principal is a number of dollars, the interest for 2 months (or 60 days) will be how many cents?

56. What is the interest for 2 months (60 days) on $58? on $9? on $236? on $16.75?

57. Knowing the interest on any sum of money for 60 days, how may we find the interest for 30 days? for 15 days? for 20 days? for 12 days? for any aliquot parts of 60 days?

58. What is the interest on $48 for 30 days? for 20 days? for 10 days?

59. What is the interest on $600 for 90 days? for 10 days? for 6 days?

60. What is the interest on $840 for 60 days? for 6 days? for 3 days? for 63 days? for 93 days?

61. What is the interest for 63 days on $400? on $240? on $7500?

62. What is the interest for 93 days on $800? on $320? on $2000?

63. The interest for 60 days being $\frac{1}{100}$ of the principal, what part of the principal equals the interest for 6 days?

64. What is the interest on $5000 for 6 days? on $63,-000? on $3500? on $4250?

65. If the principal is a number of dollars, the interest for 6 days will be how many mills?

66. What is the interest for 6 days on $50? on $185? on $700?

67. Knowing the interest on any sum of money for 6 days, how may we find the interest for 3 days? 2 days? 4 days? 1 day?

68. What is the interest on $150 for 4 days?

69. What is the interest on $24,000 for 1 day? for 5 days?

70. What is the daily interest on $10,000?

71. What is the interest for 6 days on $1000? on $3000? on $10,000?

72. What is the daily interest on $1000 at 6%? at 9%?

NOTE. — To find the interest by the above process at any other rate than 6 per cent, first find the interest at 6 per cent, and then increase or diminish that interest as the given per cent is greater or less than 6 per cent. Thus, at 9% add to the interest at 6% ½ of itself; at 7 per cent take ⅙ of the interest at 6 per cent, or add ⅙; at 5 per cent take ⅚ of the interest at 6 per cent, or subtract ⅙, etc.

73. What is the interest on $96 for 2 years 1 month at 7%? at 8%? at 5%? at 4½% (or ¾ of 6%)?

74. What is the interest on $560 for 10 months at 7½%? for 15 months at 8%?

75. What is the interest on $1000 for 90 days at 5%?

76. What is the interest on $2000 for 4 months at 8%? at 10%?

The interest on One Dollar at 6%.

107. The common method of computing six per cent interest is to find the interest for the given time on *one dollar*, and multiply that by the number of dollars in the principal. The interest on $1

being 6 cents a year is 1 cent for every 2 months (or 60 days), and 1 mill for every 6 days. Thus the interest of $1 for 4 months is 2 cents, for 1 month ½ cent, for 3 months 1½ cents, for 5 months 2½ cents, for 6 months 3 cents, etc. ; and the interest of $1 for 12 days is 2 mills; for 18 days, 3 mills ; for 3 days, ½ of a mill ; for 2 days, ⅓ of a mill ; for 7 days, 1⅙ mills, etc.

77. Find the interest of $1 for 4 months; of $5 for 4 months.

Solution. The interest of $1 for 4 months is 2 cents, and of $5 it is 5 times 2 cents, or 10 cents. *Ans.* 10 cents.

78. Find the interest of $1 for 1 month; of $10 for 1 month ; of $6 for 3 months ; of $12 for 5 months.

79. Find the interest of $1 for 6 days; of $20 for 6 days; of $30 for 12 days; of $10 for 18 days.

80. Find the interest of $1 for 3 days; of $20 for 3 days; of $30 for 2 days ; of $60 for 1 day.

81. Find the interest of $1 for 9 days; of $100 for 9 days; of $200 for 15 days ; of $600 for 7 days.

82. Find the interest of $4 for 1 year 3 months 3 days.

NOTE. — Find the interest for years, for months, and for days separately, and add the several items.

83. Find the interest of $10 for 2 y. 2 m. 18 d.

84. Find the interest of $12 for 2 y. 1 m. 15 d.

85. Find the interest of $15 for 1 y. 4 m. 9 d.

86. Find the interest of $20 for 3 y. 6 m. 12 d.

To find the rate, time, and principal.

108. 1. In what time will $100 gain $12 of interest at 6 per cent ?

Solution. The interest of $100 for 1 year at 6 per cent is $6 ; it will require as many years for $100 to gain $12 as there are times 6 in 12 ; which is 2. *Ans.* 2 years.

What time will be required

2. For $100 to gain $10 at 5 per cent ?
3. For $200 to gain $18 at 6 per cent ?
4. For $300 to gain $30 at 3 per cent ?
5. For $30 to gain $8 at 4 per cent ?

109. 1. At what rate per cent will $100 gain $6 in 2 years ?

Solution. The interest of $100 for 2 years at 1 per cent is $2 ; it will require as many times 1 per cent to gain $6, as there are times 2 in 6, which is 3.   *Ans.* 3 per cent.

At what rate per cent

2. Will $100 gain $10 in 2 years ?
3. Will $400 gain $24 in 1 year ?
4. Will $120 gain $30 in 5 years ?
5. Will $125 gain $30 in 4 years ?

110. 1. What principal will gain 60 cents of interest in 2 years 6 months at 8 per cent ?

Solution. The interest of $1 for 2 years 6 months at 8 per cent is 20 cents ; it will require as many dollars of principal to gain 60 cents of interest, as there are times 20 in 60, which is 3.   *Ans.* $3.

What principal

2. Will gain $.80 in 4 years at 2 per cent ?
3. Will gain $1 in 3 years 4 months at 6 per cent ?
4. Will gain $.50 in 2 months at 12 per cent ?
5. Will gain $1.44 in 8 months at 9 per cent ?

SECTION XL.

MISCELLANEOUS EXAMPLES FOR HIGHER GRADES.

[*Classified.*]

111. 1. A hat and a coat together cost $15. If the coat costs twice as much as the hat, what does each cost?

Solution. The coat costs the same as 2 hats; then the 15 dollars is the cost of 2 hats and 1 hat, or 3 hats. If 3 hats cost $15, 1 hat costs $5; and the coat costs the same as 2 hats, or $10.

2. What number added to twice itself gives 21?

3. A man sold a cane and a knife for 8 dollars. For the cane he received 3 times as much as for the knife. What did he receive for each?

4. A and B receive $20 for mowing a field. If A receives 4 times as much as B, what part of the money does each receive?

5. Divide $24 among A, B, and C, so that B shall have 2 times as much as A, and C as much as both A and B.

6. A man dying, left $48,000, as follows: to each of his two nephews a certain sum, to his son 4 times as much as to each of his nephews, and to his wife as much as to his son and nephews together. How much did he leave to each?

7. An estate valued at $90,000 is to be divided as follows: to each of the two daughters a certain sum, to the son, 3 times as much as to one daughter, and to the wife, as much as to one daughter and the son together. How much goes to each?

112. 8. A book and a map together, cost $15. If the book cost $1 more than the map, what did each cost?

Note. If $1 be taken from the $15, the remainder will be the cost of *two maps*. Or, if $1 be added to the $15, the sum will be the cost of *two books*.

9. Upon a tree there are 3 more sparrows than robins, and there are 15 birds, of both kinds. How many are there of each ?

10. The sum of two numbers is 17, and the difference is 3. What are the numbers?

11. At an election 23 ballots were cast for two candidates, and one candidate had 7 more ballots than the other. How many had each ?

12. A certain class consisted of an equal number of girls and boys. If, after 4 boys had left, 18 pupils remained, how many of each sex were in the class at first ?

13. In a school of 80 pupils there are three classes. The the first and second classes have an equal number of pupils, and the third class has 5 more than the first or second. How many are there in each class ?

14. The profits on a book are 45 cents. How can this sum be divided so that the publisher shall have 4 times as much as the author, and the retailer shall have 5 cents more than the author and publisher together ?

15. An estate valued at $ 62,000 is left by will as follows : To each of two grandchildren a certain sum, to the son twice as much as to the two grandchildren together, and to the widow $ 2000 more than to the son and grandchildren together. How much goes to each ?

113. 16. Divide 16 apples between Albert and Mary, giving to Mary ⅓ as many as to Albert. How many apples will each have ?

Solution. 16 apples equals Albert's share plus ⅓ of Albert's share, or ⁴⁄₃ of Albert's share. If ⁴⁄₃ of Albert's share is 16 apples, ⅓ of his share is 4 apples, and ⅜, or his whole share, is 12 apples.

17. Divide the number 10 into two such parts that the less shall be ¼ as large as the greater.

18. How shall A and B divide $ 30 between them so that B shall have ⅔ as many dollars as A ?

19. The top of a tree 64 feet high was broken off in a storm. If the part broken off was equal to ⅓ of the part standing, what was the length of each part ?

20. A steamer and a locomotive start from a landing at the same time and go in opposite directions. If the steamer goes ⅔ as fast as the locomotive, how many miles will each have gone when they are 48 miles apart ?

21. Divide 1 hour (60 minutes) into two such parts that ⅔ of the greater part shall equal the less.

22. Jane and Mary divided some cambric between themselves, so that Jane had ¼ more than Mary. What part of the cambric did each have ?

23. Mr. Mason sold a gold pencil and a pen for $22. If the price of the pencil was 20 % higher than the price of the pen, what was the price of each ?

114. 24. A can do a piece of work in 2 days, and B can do the same work in 3 days. What part of the work can A do in 1 day ? What part of it can B do in 1 day ? How long will it take both together to do the whole work ?

25. Mr. Jones can cut a lot of wood in 2 days, and his son can cut the same lot in 4 days. What part of the lot can both together cut in 1 day ? In how many days can both together cut the lot ?

26. Mary can make a cloak in 3 days, and Jane can make it in 4 days. In how many days can both make it, working together ?

27. A can walk from the town of X to the town of Y in 6 hours, and B can walk the same distance in 8 hours. If A sets out from X and B from Y, walking towards each other, at the end of how many hours will they meet ?

28. A can dig ½ of a trench in 4 days, and B can dig ⅓ of it in 2 days. How long would it take for A to dig the whole ? for B ? How many days would it take both together to dig the whole ?

29. In how many days will three men, A, B, and C, do a piece of work which A could do alone in 3 days, B alone in 5 days, or C alone in 6 days?

30. A quantity of earth can be removed by men in 12 days, by horses in 4 days, and by a steam engine in 2 days. In what time can it be removed by all together?

31. In how many hours will a cistern be filled by three pipes, if the first alone would fill it in 2½ hours, the second alone in 3½ hours, and the third alone in 6⅔ hours?

32. Lyman can make a case of boots in ⅓ of a month, and Walter can do the same work in ½ of a month? How many cases can both make in one month? How long would it take both together to make 1 case?

33. How long will it take two persons to do a piece of work which one alone could do in ⅓ of a day, or the other alone in ¼ of a day?

34. One pump will fill a tank in ¾ of an hour and another in ⅔ of an hour. How long will it take both pumps to fill the tank?

35. If 1 pound of tea will last a man and his wife together 2 weeks, and if it will last the man alone 6 weeks, how long would it last the woman alone?

NOTE. The wife in one week uses the difference between ½ and ⅙ of the tea.

36. Mary and Ellen together can do the washing for a certain family in 4 hours. If Ellen can do it alone in 6 hours, in what time can Mary do it alone?

37. Three men, A, B, and C can dig a ditch in 3 days. A alone could dig it in 6 days, or B alone in 8 days. In how many days could C alone dig it?

38. A bath tub can be filled by the hot and cold water pipes in 4 minutes, and when full it can be emptied by the waste pipe in 5 minutes. It is half full, and all three pipes are set running. When will the tub be full?

39. A man does $\frac{2}{3}$ of a piece of work in 10 days, then another joins him and they finish the work in 6 days more. In how many days would each have done it alone ?

115. 40. Charles bought an equal number of 2-cent stamps and 3-cent stamps, paying for the whole 15 cents. How many of each kind did he buy ?

Solution. For 1 of each kind he would pay 5 cents ; hence, for 15 cents he could buy as many of each kind as there are 5's in 15.

41. A tailor had 36 yards of cloth, which he wished to cut so as to have an equal number of coats and vests, the coats to contain $6\frac{1}{2}$ yards each, and the vests $2\frac{1}{2}$ yards each. How many of each could he have ?

42. A trader bought some sheep at $5 apiece and as many more at $7 apiece. He sold them at $8 apiece, thereby gaining $70. How many sheep were there ?

43. A grocer mixes two kinds of sugar in equal quantities, one of which cost 6 cents a pound and the other 5 cents a pound. He sells the mixture for $1.10, and thereby makes 11 cents. How many pounds of each kind of sugar did the mixture contain ?

44. Hay worth $25 a ton is mixed with other hay worth $18 a ton in equal portions. What is a ton of the mixture worth ?

45. How long will it take a person to make a journey of 50 miles if he rides half the time at the rate of 9 miles an hour and walks the rest of the time at $3\frac{1}{2}$ miles an hour ?

46. How many hours will it take a girl to earn $5 if she works half the time for 12 cents an hour and half the time for 18 cents an hour ?

47. A fruit dealer has apples which he sells, some for $2 a barrel, some for $3, and some for $4. If he sells an equal number of each kind, and receives $72 for the lot, how many barrels of each kind does he sell ?

48. A druggist receives an order for an· equal quantity of each . of three kinds of drugs, one kind being worth $ $\frac{3}{4}$, another worth $ $1\frac{1}{4}$, and the other worth $2 a pound. If he receives $ 50 for the whole, how many pounds of each kind are required to fill the order?

49. A shoe dealer fills an order for $70 worth of boots, one kind worth $4 a pair, another worth $3 a pair. Of the latter kind there are twice as many pairs as of the former. How many pairs of each kind are required?

50. A grocer mixed some rice that cost 9 cents a pound with twice as much more that cost 6 cents a pound. How much did he gain by selling 50 pounds of the mixture at 8 cents a pound?

51. A confectioner bought glass jars, some at 1\frac{5}{8}$, and some at 2\frac{3}{4}$ apiece, of the former kind 4 times as many as of the latter. If he paid $ 60 for the lot, how many of each kind did he buy?

52. A man worked 4 days at $ 2.50 a day, 9 days at $3.00; and 2 days at $1.50. What were his average daily wages?

53. One half of a certain farm is worth $100 an acre, $\frac{1}{4}$ of it $50 an acre, and the rest $30 an acre. What is the average price an acre?

54. One third of Henry's ducks cost him 75¢ apiece; $\frac{1}{4}$ of them cost 50¢ apiece; and the rest cost 60¢ apiece. What is the average cost apiece of the whole?

116. **55.** What is the ratio of 2 to 3; that is, 2 is what part of 3?

NOTE. Ratio means relation. In finding the relation of two numbers, we find either what part one number is of another or how many times one number contains the other. Thus, the ratio of 2 to 4 is $\frac{1}{2}$; the ratio of 4 to 2 is 2. The two numbers thus compared are the *terms* of the ratio. The second term is always regarded as the divisor.

56. What is the ratio of 3 to 6? of 6 to 3? of 3 to 4?

57. Two numbers are in the ratio of 5 to 2. If the larger number is 20, what is the smaller number?

58. The ages of two boys are in the ratio of 3 to 4. If the age of the younger is 12 years, what is the age of the elder ?

NOTE. The ratio of 3 to 4 is $\frac{3}{4}$; hence 12 years is $\frac{3}{4}$ of the age of the elder boy.

59. Two numbers are in the ratio of 3 to 5, and their sum is 16. What are the numbers ?

NOTE. If the 16 be divided into 8 equal parts, 3 of these parts will be one number and 5 of them will be the other.

60. How can you divide $18 between two persons, so that their shares shall be in the ratio of 4 to 5 ?

61. Divide the number 24 into two parts, which shall be in the ratio of 1 to $\frac{1}{2}$.

62. The sum of 2 numbers is 390, and they are to one another as 5 to 8. What are the numbers ?

63. Divide a kite line 100 yards long into two parts which shall be to each other as 3 to 5.

64. A father gave his two children 60 cents, which they are to share in proportion to their ages, 10 and 14 years. What is the share of each ?

65. It is required to saw a board 30 feet long into three pieces proportional in length to the numbers 3, 4, and 5.

NOTE. If we suppose the whole length, 30 feet, to be divided into $3 + 4 + 5$ or 12 equal parts, one piece will contain 3, another 4, and another 5 of these equal parts. The lengths are respectively $\frac{3}{12}$, $\frac{4}{12}$, and $\frac{5}{12}$ of 30 feet.

66. Three boys, who are 12, 14, and 16 years old respectively, are to share $63 in proportion to their ages. What is the share of each ?

67. C and D hired a pasture for $25. C pastured 3 horses, and D pastured 2 horses. How much should each pay ?

Solution. Both together pastured 5 horses. Since C pastured 3 horses, he should pay $\frac{3}{5}$ of $25, which is $15 ; and since D pastured 2 horses, he should pay $\frac{2}{5}$ of $25, which is $10.

68. Two farmers bought a stack of hay for $45. One fed 5 horses and the other 4 horses until it was all eaten. How much should each pay?

69. John and Frank sold some berries for 50 cents. If John sold 6 quarts, and Frank sold 4 quarts, how many cents should each receive?

70. Winn had $5, and Webb had $7. They loaned their money for one year, and received 84 cents as interest. How many cents should each boy have?

71. Two woodmen agree to cut a lot of lumber for $100. One, with three hired men, works 5 days; and the other, with four hired men, works 6 days. How much of the money should each receive?

72. A, B, and C did a piece of work together. A worked 2 days, B worked 3 days, and C worked 4 days. If they received $36 for their work, what was the share of each?

73. Three men, A, B, and C working together, build a wall for $30. A could build it alone in 15 days, B alone in 12 days, and C alone in 10 days. If they share the pay according to ability to work, what is each man's share?

74. Two drovers hired a pasture together for $7. The first put in 4 oxen, and the second 30 sheep. What should each pay if 1 ox eats as much as 10 sheep?

75. A and B engage to dig a pit for $360. To do the work, A sent 5 men and 4 boys, and B sent 8 men and 6 boys. How much money should each receive, supposing that a boy does half as much work as a man?

76. A put 20 oxen, B 27 cows, and C 35 sheep into a pasture, for which they paid $96. What should be paid by each, supposing that 2 oxen eat as much grass as 3 cows or 7 sheep?

77. In a pasture are 5 horses belonging to A, 20 oxen belonging to B, and 15 cows belonging to C. What is each man's proportion of the rent, supposing that 1 horse eats as much grass as 2 oxen or 3 cows?

78. Six men and 6 boys do a piece of work, for which they receive $60. If 3 boys do as much work as 2 men, what will each man receive? what will each boy receive?

79. Mr. G. and Mr. B. entered into partnership. Mr. G. put in $2 as often as Mr. B. put in $1. If they lost $75, what was each one's share of the loss?

NOTE. As often as $3 were put in, Mr. G. put in $2, and Mr. B. $1; therefore Mr. G. should bear ⅔ of the loss and Mr. B. ⅓.

80. Mr. D. and Mr. F. enter into partnership. The money Mr. D. invests is to the money Mr. F. invests in the ratio of 3 to 4. If they gained $56, what was each one's share?

81. John, Frank, and Theodore invested their money in apples. John's money was to Frank's as 2 to 3, and Theodore had as much money as both of them. If they bought 50 apples, how many should each boy receive?

82. X and Y enter into partnership. X puts in $5 and his time, which he values at $10, and Y puts in $10. If they gain $20, what is each one's share?

83. A, B, and C fit out a ship for a voyage. A furnished $4000, B $5000, and C $7000. The profits of the voyage amount to $20,000. What is each partner's share?

84. C and D hire a pasture for the summer, paying $20 for the use of it. C pastures 3 cows for 2 months and D pastures 1 cow for 4 months. What part of the $20 should each pay?

Solution. The pasturing of 3 cows for 2 months is the same as the pasturing of 6 cows for 1 month; and the pasturing of 1 cow for 4 months is the same as the pasturing of 4 cows for 1 month; so it is the same as if C pastured 6 cows, and D 4 cows, or 10 cows altogether, for 1 month. C's share of the cost should be $\frac{6}{10}$ of $20, or $12, and D's share should be $\frac{4}{10}$ of $20, or $8.

85. The type for a book was set for $144. One office furnished 2 compositors for 7 days and another 5 for 2 days. How much should each office receive?

86. Mr. Brown and Mr. Smith hire a stable together for $72, agreeing to share the expense in proportion to the use made of it. Mr. Brown keeps there 5 horses for 3 months, and Mr. Smith 8 horses for 7 months. What rent should each pay ?

117. 87. Homer and Robert together have 10 peaches. ½ of Homer's share equals ⅓ of Robert's. How many has each ?

NOTE. If ½ of Homer's share is equal to ⅓ of Robert's, ⅔, or the whole of Homer's share, equals ⅔ of Robert's. So their shares are in the ratio of 2 to 3, and the question is to divide 10 peaches into two parts in that ratio.

88. The sum of two numbers is 42, and ⅓ of the less is equal to ¼ of the greater. What are the numbers ?

89. In an orchard containing 120 apple and pear trees, ¼ of the number of apple trees equals ⅓ of the number of pear trees. How many trees of each kind ?

90. The cost of a boat and rigging was $65, and ½ of the cost of the boat was equal to ⅗ of the cost of the rigging. What was the cost of each ?

91. At what time of day is it true that ½ of the time since noon is equal to the time before midnight ?

92. What o'clock is it when 4/7 of the time past midnight is equal to the time to midnight again ?

93. What is the time by the clock when ⅔ of the time since midnight equals the time before noon ?

94. The difference between two numbers is 6, and the less number is ¼ of the greater. What are the numbers ?

NOTE. The difference between the two numbers is equal to ¾ of the greater number. So ¾ of the greater number equals 6.

95. At what time of day is the time passed since 9 o'clock equal to ⅓ of the time passed since 8 o'clock ?

96. At what time of day is $\frac{1}{7}$ of the time past midnight equal to the time past noon ?

97. $\frac{3}{8}$ of A's age equals $\frac{2}{5}$ of B's age, and the sum of their ages is 31 years. What is the age of each ?

NOTE. If $\frac{3}{8}$ of A's age equals $\frac{2}{5}$ of B's age, $\frac{1}{8}$ of A's age equals $\frac{1}{3}$ of $\frac{2}{5}$ or $\frac{2}{15}$ of B's age, and $\frac{8}{8}$, or the whole of A's age, equals 8 times $\frac{2}{15}$ or $\frac{16}{15}$ of B's age. Their ages then are as 16 to 15.

98. Two thirds of A's money is equal to four fifths of B's money, and together they have $\$121$. How many dollars has each ?

99. At what time between one and two o'clock will $\frac{2}{3}$ of the time past one, equal $\frac{1}{4}$ of the time before two ?

100. The difference between two numbers is 21, and $\frac{2}{3}$ of the greater equals $\frac{4}{6}$ of the smaller. What are the numbers ?

NOTE. The greater number is $\frac{12}{8}$ of the smaller, and their difference is $\frac{4}{8}$ of the smaller. Or, the smaller number is $\frac{8}{12}$ of the larger, and their difference is $\frac{4}{12}$ of the larger. So 21 equals $\frac{4}{8}$ of the smaller, or $\frac{4}{12}$ of the larger number.

101. In a school room are 14 more girls than boys ; and $\frac{3}{4}$ of the number of boys is equal to $\frac{2}{5}$ of the number of girls. How many of each are there ?

102. At what o'clock is $\frac{2}{3}$ of the time past 4 o'clock equal to $\frac{7}{10}$ of the time past 5 o'clock ?

103. After George had spent $\frac{1}{3}$ of his money and Alfred $\frac{1}{4}$ of his they had equal sums left. How much had each at first, if together they had 85 cents ?

104. A had $\$3$ more than B ; but when A had spent $\frac{1}{3}$ of his money and B $\frac{1}{6}$ of his, they had equal sums left. How much had each at first ?

105. A mast was broken $3\frac{1}{2}$ feet below its middle point into two parts, such that $\frac{1}{4}$ of the shorter part equals $\frac{1}{6}$ of the longer. How long was the whole mast, and how long is each part ?

NOTE. The difference between the two parts is twice $3\frac{1}{2}$ feet or 7 feet.

106. A and B set out from two towns to meet on the road. When they met 6 miles from the half-way point they found that ⅔ of the distance A had come was equal to ½ of the distance B had come. How far had each come? What was the distance between the towns?

107. Three fifths of A's money is equal to ⅝ of B's money; but if A should give B a dollar, each would have the same amount. How much has each now?

108. A person having 7 hours at his disposal proposes to ride from home in a coach as far as he can, and walk back. How far can he go if the coach travels 10 miles an hour, and he walks 4 miles an hour?

NOTE. If he walks 4 miles an hour, it takes him 2½ hours to walk as far as the coach goes in 1 hour. The times spent in walking and riding must, therefore, be in the ratio of 2½ to 1 or 5 to 2.

109. How far can a person travel in 33 hours if he walks half the distance at the rate of 3 miles an hour, and rides the other half at the rate of 8 miles an hour?

110. A boat's crew that can row 8 miles an hour in still water rows down stream a certain distance and back again in 4 hours. How far does it go, if the stream flows at the rate of 4 miles an hour?

118. 111. A is 50 rods ahead of B, who is in pursuit. If B runs 30 rods and A 28 rods a minute, how long will the chase continue?

NOTE. B gains 2 rods a minute, and has 50 rods to gain.

112. A fox is 40 rods ahead of a hound and runs 8 rods while the hound runs 9. How far must the hound run to catch the fox?

NOTE. He must run 9 rods to gain 1 rod.

113. A clock-face is marked off into 12 spaces, and the hour hand goes over 1 of these spaces every hour. How many such spaces does the minute hand go over in an hour?

114. At 12 o'clock the two hands are together, and the minute hand starts off in pursuit of the hour hand, having the whole circle of the clock-face to gain. Where are the hands at 1 o'clock? How many spaces has each hand gone over in the hour? How many spaces has the minute hand *gained* on the hour hand in one hour?

115. At 1 o'clock the minute hand has one space to gain on the hour hand before overtaking it. What part of an hour will the minute hand take to do this? How many minutes? Then at how many minutes past 1 o'clock will the two hands be together?

116. At 2 o'clock, where are the hands? How many spaces has the minute hand to gain on the hour hand before overtaking it? At how many minutes past 2 o'clock will the hands be together?

117. At what time between 6 and 7 o'clock are the hour and minute hands together? At what time between 10 and 11?

118. At how many minutes past 11 o'clock will the hands be together?

119. During the time from noon to midnight how many times are the hour and minute hands together, and at what intervals of time?

119. 120. A father is 30 years old and his son is 4. In how many years will the age of the son be just ½ of the age of the father?

Note. The difference between their ages is and always will be 26 years. When the son's age comes to be ½ the father's age, the difference between the two will be ½ the father's age. Hence 26 years equals ½ the father's age at that time.

121. William and Giles can each earn $1 in a day. William has already worked 8 days, and Giles has worked 2 days. How many more days must each work before William's money will be just double Giles'?

122. A mother is 35 years old and her son is 5. In how many years will the son's age be ⅕ of the mother's age ?

123. A man is now 40 years old and his wife 30. In how many years will her age be ⅔ of his age ?

124. A mother is 40 years old and her son is 22. How many years is it since the son was ½ as old as the mother ?

125. Arthur is now 28 years old and Mary is 18. How many years since Mary's age was ⅔ of Arthur's ?

126. A has $48 and B has $36. How much must each spend in order that B may have only ½ as much as A ?

127. C has $26 and D has $38. How much must each earn in order that C may have ₁₁/₁₅ as much as D ?

128. One pole is 50 feet long and another 40 feet. A piece of the same length is to be cut from each so that the remaining parts shall be to each other as 7 to 5. What must be the length of the pieces cut off ?

120. 129. By selling a piece of calico at 10 cents a yard which should have been sold at 13 cents, I lost 90 cents. How many yards were there in the piece ?

130. Thomas wishes to buy a certain number of chickens. To buy one kind at 25 cents apiece would require $1 more than to buy another kind at 20 cents apiece. How many does he wish to buy ?

131. John gave 2 pears apiece to his cousins, and had 5 pears left. If he had given them 4 apiece, he would have wanted 3 more pears. To how many cousins did he give the pears ?

NOTE. It would have required 5 + 3 or 8 pears more to give them 4 apiece than to give them 2 apiece. If it required 8 pears more to give 2 more pears to each cousin, there must have been as many cousins as there are 2's in 8.

132. By selling a lot of ploughs at $15 each, a merchant will gain $70. By selling them at $18 each, he will gain $91. How many ploughs are there in the lot ?

133. A man bought some bouquets at 25 cents apiece, and had 20 cents left. If he had bought the same number at 27 cents each, he would have wanted 10 cents more to pay for them. How many did he buy?

134. A man bought cloth at the rate of $3 for 4 yards, sold it at the rate of $7 for 6 yards, and gained $15. How many yards were there?

135. A man agreed to pay a laborer $3 a day for every day he worked, and the laborer was to forfeit $1 for every day he was idle. At the expiration of 10 days he received $22. How many days was he idle?

NOTE. If he had worked 10 days he would have received $30. This sum is diminished for every day he is idle by $3, the wages he would have earned, and $1, the forfeit, or $4 in all.

136. A man was hired to work for $3 a day, but on condition that for every day he was idle he should forfeit $1.50. At the end of 20 days he received $33. How many days had he been idle?

137. A painter earns $15 a week when he has work, and he pays $4 a week for his board all the time. How many weeks has he worked if at the end of 10 weeks he has saved $50?

121. 138. In what proportion must sugar worth 14¢ a pound be mixed with another sort worth 9¢, that the mixture may be worth 12¢ a pound?

Solution. On every pound of the better sort there is a loss of 14¢ less 12¢, or 2¢. On every pound of the poorer sort there is a gain of 3¢. With every pound of the better sort, on which 2¢ is lost, there should be put enough of the poorer sort to make a gain of 2¢. Since 1 pound of the poorer sort makes a gain of 3¢, ⅔ of a pound will make a gain of 2¢. So with every pound of the better sort must be put ⅔ of a pound of the poorer, or, with 3 pounds of the better, 2 pounds of the poorer. *Ans.* In the proportion of 3 to 2.

139. In what proportion must coffee worth 16 ¢ and coffee worth 22 ¢ a pound be mixed that the mixture may be worth 20 ¢ a pound ?

140. In what proportion must alcohol worth $3 a gallon be mixed with water that the mixture may be worth $2 a gallon ?

141. A grocer having two kinds of tea worth 40 ¢ and 60 ¢ a pound, respectively, wishes to fill a box holding 36 pounds with a mixture worth 55 ¢ a pound. How many pounds of each must he take ?

142. How many pounds of rice worth 5 ¢ a pound must be mixed with 8 pounds worth 8 ¢ a pound that the mixture may be worth 7 ¢ a pound ?

143. A man invested a certain sum of money, and calculated his profit on the venture at 15½ % ; but afterwards collecting $150, which he had given up as a bad debt, found that his profit rose to 15¾ %. What was the sum invested ?

144. The rate of interest on certain bonds having been reduced from 7½ % to 6 %, one holder finds his income thereby made $69 a year less. What is the face value of the bonds he holds ?

145. A man sold 2 cows for $60 each. On one he gained 20 % and on the other he lost 20 %. On both together did he gain or lose ?

146. A man sold one horse for $180, which was at a loss of 25 %. At what price must he sell another horse costing the same to gain enough to offset this loss ?

147. A sold a piece of land to B, gaining 25 % ; B sold it to C, gaining 40 %. If C gave 35 ¢ a foot for it, what did A give ?

148. If you buy apples at the rate of 3 for 2 cents, and sell them at the rate of 2 for 3 cents, what per cent do you gain ?

149. If goods bought 20 % below the wholesale price are sold 20 % above that price, what per cent is gained ?

150. What per cent does a man gain if he asks 20 % more than cost, and then takes off 10 % from his asking price ?

151. Stocks bought 10 % below the original value, must be sold at what per cent above the original value to gain 20 % ?

NOTE. $\frac{120}{100}$ of 90 is what part of 100 ?

152. A trader gained $320 by selling at 20 % above wholesale price a lot of goods he had bought at 20 % below wholesale price. How much did the goods cost him ?

153. A lot of goods is sold at $\frac{1}{2}$ of the retail price ; but the retail price is an advance of 80 % on the cost. What is the actual loss per cent ?

154. What must I ask for lace costing $5 a yard, that after falling 25 % on my price, I may gain 20 % on the cost ?

155. A lot of oil lost 10 % by leakage, but the remainder was sold at an advance of 20 % on its cost. What per cent was gained on the whole ?

156. The wholesale price of some goods is 25 % less than the retail price, and the retail price is an advance of 50 % on the cost. What per cent is gained by selling at the wholesale price ?

157. The wholesale price of an article being an advance of 30 % on the cost, and the retail price an advance of 60 % on the cost, what per cent does a dealer gain if he buys at the wholesale and sells at the retail price ?

158. A trader having lost 20 % of his goods by fire, hopes to sell the remainder for enough to cover his loss. At what per cent above cost must the selling price be ?

159. The wholesale price of a certain article is an advance of 25 % on the cost, and the retail price is an advance of 60 % on the wholesale. What per cent above cost is paid by one who purchases at a discount of 33⅓ % on the retail price ? What per cent above the wholesale price ?

160. A fruit dealer lost 25 % of his fruit, and sold the remainder for enough to gain 20 % on the whole cost. What per cent did he gain on that sold ?

161. I bought a box of oranges for $6, but 20% of the fruit proving unsound, what did the sound fruit really cost me ?

162. If ⅔ of a yard of cloth is sold for what ⅘ of a yard cost, what per cent is gained ?

163. A sum of money at simple interest amounts to $345 in 3 years and to $375 in 5 years. What is the rate of interest, and the sum of money ?

164. A man sold a horse and carriage for $480. On the horse he lost 25%, on the carriage he gained 25%, and the gain on the latter just offset the loss on the former. What was the cost, and what the price received for each ?

165. By what per cent is the labor of sawing fire-wood increased if each stick is cut into 4 parts instead of 3 ?

166. If wages are raised 20% and then cut down 20%, how do they compare with what they were at first ?

MISCELLANEOUS PROBLEMS.

[*Unclassified.*]

122   **167.** A quantity of sugar worth 8¢ a pound is mixed with twice as much of another grade worth 10¢ a pound. What is one pound of the mixture worth ?

168. A man worked 15 days, having his son to work with him 10 days, and received $40. What were the wages of each if the son earns half as much as the father in a day ?

169. Walter and George hire a boat for $9. Walter invites 7 and George 3 guests to accompany them. How much more has Walter to pay than George for the use of the boat ?

170. Three boys hired a horse for a season agreeing to take turns in using him, and to share expense in proportion to the time each should use him. One used him 2 weeks and 1 day, another 2 weeks and 4 days, and the other 3 weeks and 2 days. The expense was $35. What was each boy's share of it ?

171. A and B set out from places 50 miles apart and travelled towards each other till they met. How far did each travel, if A travelled as far in 2 hours as B did in 3 hours ?

172. Two men are paid $98 for doing some work. What should each get if one does as much work in 3 days as the other does in 4 days ?

173. Three wayfarers sat down by the roadside for a simple repast. A furnished 2 loaves, B 3 loaves, and C gave 30 cents to be divided properly between A and B. What should be the share of each ?

174. A pound of tea lasted a man 15 days, and it would have lasted his wife 12 days. How long· will a pound last both ?

175. Suppose a cistern has one pipe which will fill it in 4 hours, and another which will empty it in 3 hours. If the cistern is full, and the water is allowed to run freely through both pipes, in what time will the cistern be emptied ?

176. There were two equal sums of money on interest, one for 2 years at 3%, and the other for 1 year at 4%. The interest on both sums was $1.20. What was the interest on each ? What was the value of each sum ?

177. Mr. Chapin gave his two boys $2, and told them to divide the money between them in the ratio of their ages. If one of the boys was 9 years old and the other 11, how much did each boy receive ?

178. Two travellers set out at the same time from different towns and travel towards each other. A's horse will travel from one town to the other in 4 hours, and B's in 5 hours. In how many hours after they start do they meet ?

179. If to $\frac{1}{10}$ of a person's age, $\frac{1}{3}$, $\frac{1}{4}$, $\frac{1}{5}$, and $\frac{1}{6}$ of his age is added, the sum will be 1 year less than his age, how old is he ?

180. Willie has some coins arranged in eight rows, and finds that if they were arranged in twelve rows each row would be 4 coins shorter. How many coins has he ?

181. Ten pounds of raisins worth 14¢ a pound are mixed with fifteen pounds worth 20¢ a pound. What is the mixture worth a pound ?

182. Twenty men dined together at a tavern, but before the reckoning was paid 4 of the number went away, leaving the rest to pay, whereby each man's reckoning was increased half a dollar. How much would each have paid if all had stayed ?

183. Twelve persons engage a picnic wagon for a certain sum, but 4 more joining the party, the expense to each is diminished by $\frac{3}{4}$ of a dollar. What was paid for the wagon ?

184. A, B, and C can do a piece of work in 4 days; B and C can do it in 6 days; C and A can do it in 8 days; in how many days can each do it alone ?

185. A pole stands $\frac{1}{3}$ under water, but if the water should rise a foot and a half $\frac{2}{3}$ of the pole would be under water. How long is the pole ?

186. In a certain school the average absence of the boys is 7 per cent, that of the girls 5 per cent. What is the per cent of absence for the whole school if the number of boys equals the number of girls ? if the number of boys is double the number of girls? if the number of girls is double the number of boys ?

187. A fox is 40 leaps before a hound, and makes 3 leaps while the hound makes 2, but 2 of the hound's leaps cover as much ground as 4 of the fox's. How many leaps will the hound take to catch the fox ?

188. A man spent half his money and half a dollar; then half of what he had left and half a dollar, when he had $16 remaining. How much money had he at first ?

189. A man went to market with a certain number of pigs. The first day he sold $\frac{2}{3}$ of them, the next day he sold 6 pigs more than $\frac{1}{2}$ of the remainder, after which he had 4 pigs left. How many had he at first?

190. Two men in copartnership gain $240 ; one of them put in $100 more than $\frac{2}{3}$ of the stock and had $100 as his share of the gain. What was the whole stock, and each partner's share of it?

191. On looking at my watch I reckon that the time from noon up to 3 hours ago is equal to $\frac{4}{7}$ of the time from 3 hours hence to midnight. What is the time of day ?

192. Divide $ 6700 between A and B in such a way that A's share at interest 12 years at 5 % shall amount to the same as B's share in 10 years at 7½ %.

193. Two fifths of a certain fund is put on interest at 7 %, and the remainder on interest at 5 % a year. The income from one part of the fund exceeds by $ 40 a year the income from the other part. What is the value of the whole fund, and of each part ?

194. A quantity of fodder will last a horse and a cow 4 months. How long will it last each, if the cow eats only $\frac{2}{3}$ as much as a horse in a given time ?

195. A detachment is sent out with provisions to last 12 days. At the end of 3 days one half of the detachment is ordered to return, taking with it one fourth of the provisions then unconsumed. How long will the remainder of the provisions last the other half of the detachment ?

196. A drover having lost $\frac{1}{4}$ of his cattle sold $\frac{1}{2}$ of the remainder at an advance of 50 % on the cost, getting $ 450, and then at the same advance sold all but 3 of what remained for $ 360. How many cattle had he at first, and what did they cost ?

197. After A had spent $\frac{1}{5}$ of his money and B $\frac{2}{7}$ of his, they had equal sums remaining, but B had spent $ 6 more than A. How much money had each at first ?

198. A's hat and coat together cost $ 15; his hat and vest together cost $ 13; his vest and coat together cost $ 18; what was the cost of each article ?

199. A traveller wishing to be at a certain place at 12 o'clock, finds if he starts at a certain time and goes at the rate of 10 miles an hour he will be 2 hours early, but if he goes at the rate of 6 miles an hour he will be 2 hours late. What is the length of his journey ?

200. A man finds that if he gives 12 peaches apiece to some girls he will have 5 peaches left, but if he tries to give them 15 apiece he needs 25 more. How many girls are there? How many peaches has he?

201. A boy had a certain number of apples. If he had sold them at the rate of 2 for 1 cent, he would have lost 2 cents, but by selling them at the rate of 3 for 2 cents, he gained 7 cents. How many apples had he?

202. A boy lost 20 of his chickens; then he bought a number equal to ⅓ of those he had left, after which he had ½ as many as he had at first. How many had he at first?

203. A and B can do a piece of work in 5 days; B and C in 6 days, and A and C in 10 days; in what time can all do it together? In what time can each do it alone?

204. Two purses have an equal number of coins in each, but if 2 coins be taken out of one and put into the other, the latter will then contain ⅔ of the whole number of coins in both. How many coins in each?

205. A workman at the end of the week having saved a certain sum of money, earned $28 more the following week, then spent ⅓ of all his money, and found he had left twice as much money as he had at the end of the week before. How much had he then?

206. A hare is 20 leaps before a dog and takes 9 leaps while the dog takes 4, but 3 of the dog's leaps reach as far as 7 of the hare's. How many leaps can the hare make before she is caught?

207. A farmer sold half of his herd of cows and half a cow to A, then half of what he had left and half a cow to B, and then half of what he had left and half a cow to C, after which he had 10 cows left. How many cows had he at first, and how many did he sell to each buyer?

APPENDIX.

TABLE FOR DRILL IN WHOLE NUMBERS.

	i.	ii.	iii.	iv.	v.	vi.	vii.	viii.	ix.	x.
a.	5	14	27	31	48	56	69	72	87	93
b.	3	11	25	39	50	54	68	76	82	94
c.	2	19	23	38	47	51	70	74	86	91
d.	6	18	22	40	45	59	67	71	84	99
e.	4	20	26	37	43	58	65	79	81	100
f.	1	17	24	35	42	60	63	78	89	92
g.	9	15	21	33	46	57	62	80	88	96
h.	8	13	29	32	44	55	66	77	90	95
j.	10	12	28	36	41	53	64	75	83	97
k.	7	16	30	34	49	52	61	73	85	98

Dictation Exercises on the Table.

ADDITION.

1. To each number in the first column

1. Add 1.	3. Add 3.	5. Add 5.	7. Add 7.	9. Add 9.
2. Add 2.	4. Add 4.	6. Add 6.	8. Add 8.	

Explanation. In exercise 1 the pupil will give at sight results thus : " 6, 4, 3, 7, 5," and so on ; in exercise 2 he will say "7, 5, 4, 8, 6," and so on. In the same way he will give answers to the other exercises.

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2. To each number in any column the teacher may select,

10. Add 1.	12. Add 3.	14. Add 5.	16. Add 7.	18. Add 9.
11. Add 2.	13. Add 4.	15. Add 6.	17. Add 8.	

3. To each number in any column the teacher may select,

19. Add 10.	21. Add 12.	23. Add 14.	25. Add 16.	27. Add 18.
20. Add 11.	22. Add 13.	24. Add 15.	26. Add 17.	28. Add 19.

4. In the same way the teacher may dictate the addition of the numbers from 20 to 99.

5. In each line *a.*, *b.*, *c.*, etc., of the table, add together the numbers expressed in columns

29. i. and ii.	32. iv. and v.	35. vii. and viii.
30. ii. and iii.	33. v. and vi.	36. viii. and ix.
31. iii. and iv.	34. vi. and vii.	37. ix. and x.

Explanation. In exercise 29 the pupil will give his answers thus : " 19, 14, 21," and so on ; in exercise 30 he will say " 41, 36, 42," and so on.

6. In each column, i., ii., iii., etc., of the table, find the sum of the numbers expressed in lines

38. *a.* and *b.*	41. *d.* and *e.*	44. *g.* and *h.*
39. *b.* and *c.*	42. *e.* and *f.*	45. *h.* and *j.*
40. *c.* and *d.*	43. *f.* and *g.*	46. *j.* and *k.*

Explanation. In exercise 38 the pupil will give his answers thus : " 8, 25, 52," and so on; in exercise 39 he will say " 5, 30, 48, 77," and so on.

7. 47. In each column, i., ii., iii., etc., add as many of the numbers as the teacher may direct.

8. 48. Add the numbers expressed in each of the lines, *a.*, *b.*, *c.*, etc.

Dictation Exercises on the Table, p. 161.

SUBTRACTION.

9. From each number in any column, ii., iii., etc., that the teacher may name,

49. Take 1.	52. Take 4.	55. Take 7.
50. Take 2.	53. Take 5.	56. Take 8.
51. Take 3.	54. Take 6.	57. Take 9.

10. From each number in any column, iii., iv., v., etc.,

58. Take 10.	61. Take 13.	64. Take 16.
59. Take 11.	62. Take 14.	65. Take 17.
60. Take 12.	63. Take 15.	66. Take 18.

11. In the same way the teacher may dictate the subtraction of the numbers 20 to 29 from the numbers in any column from iv. to x.; of 30 to 39 from the numbers in any column from v. to x., and so on.

12. In each line a., b., c., etc., of the table, take the number expressed in

67. i. from ii.	70. iv. from v.	73. vii. from viii.
68. ii. from iii.	71. v. from vi.	74. viii. from ix.
69. iii. from iv.	72. vi. from vii.	75. ix. from x.

Explanation. In exercise 67 the pupil will give his answers thus : "9, 8, 17," and so on ; in exercise 68 he will say "13, 14, 4," and so on.

13. In each column of the table find the difference

76. Of a. and b.	79. Of d. and e.	82. Of g. and h.
77. Of b. and c.	80. Of e. and f.	83. Of h. and j.
78. Of c. and d.	81. Of f. and g.	84. Of j. and k.

14. 85. Name the number that must be added to each number in the table to make 100.

TABLE FOR DRILL IN WHOLE NUMBERS.

	i.	ii.	iii.	iv.	v.	vi.	vii.	viii.	ix.	x.
a.	5	14	27	31	48	56	69	72	87	93
b.	3	11	25	39	50	54	68	76	82	94
c.	2	19	23	38	47	51	70	74	86	91
d.	6	18	22	40	45	59	67	71	84	99
e.	4	20	26	37	43	58	65	79	81	100
f.	1	17	24	35	42	60	63	78	89	92
g.	9	15	21	33	46	57	62	80	88	96
h.	8	13	29	32	44	55	66	77	90	95
j.	10	12	28	36	41	53	64	75	83	97
k.	7	16	30	34	49	52	61	73	85	98

Dictation Exercises on the Table.

MULTIPLICATION.

15. Multiply each number in column i.,

86. By 2.	89. By 5.	92. By 8.	95. By 11.
87. By 3.	90. By 6.	93. By 9.	96. By 12.
88. By 4.	91. By 7.	94. By 10.	

16. Multiply each number in any given column

97. By 2.	100. By 5.	103. By 8.	106. By 11.
98. By 3.	101. By 6.	104. By 9.	107. By 12.
99. By 4.	102. By 7.	105. By 10.	

17. In the same way the teacher may dictate the multiplication of the numbers in the table, by 20, 30, 40, 50, etc., to 100.

DIVISION.

18. Divide each number in columns

108. ii. to iii. by 2.	113. ii. to viii. by 7.
109. ii. to iv. by 3.	114. ii. to ix. by 8.
110. ii. to v. by 4.	115. ii. to x. by 9.
111. ii. to vi. by 5.	116. ii. to x. by 11; by 12.
112. ii. to vii. by 6.	

Explanation. In exercise 108 the pupil will give his answers thus : " 7 ; 5 and 1 over ; 9 and 1 over," and so on. In exercise 109 he will say : " 4 and 2 over; 3 and 2 over ; 6 and 1 over," and so on.

19. Divide each number in columns

117. iv. to x. by 2.	119. vi. to x. by 4.	121. viii. to x. by 6.
118. v. to x. by 3.	120. vii. to x. by 5.	122. ix. to x. by 7.

20. What is

123. 1 half of each number in columns i. to iii. ? iv. to x. ?

124. 1 third of each number in columns i. to iv. ? v. to x. ?

125. 1 fourth of each number in columns i. to v. ? vi. to x. ?

126. 1 fifth of each number in columns i. to vi. ? vii. to x. ?

127. 1 sixth of each number in columns i. to vii. ? viii. to x. ?

128. 1 seventh of each number in columns i. to viii. ? ix. to x. ?

129. 1 eighth of each number in columns i. to ix. ? in x. ?

130. 1 ninth of each number in columns i. to x. ?

131. 1 tenth of each number in columns i. to x. ?

132. 1 eleventh of each number in columns i. to x. ?

133. 1 twelfth of each number in columns i. to x. ?

TABLE FOR DRILL IN FRACTIONS.

	i.	ii.	iii.	iv.	v.	vi.	vii.	viii.	ix.	x.
a.	$\frac{2}{3}$	$\frac{3}{4}$	$\frac{4}{5}$	$\frac{5}{6}$	$\frac{6}{7}$	$\frac{7}{8}$	$\frac{8}{9}$	$\frac{9}{10}$	$\frac{10}{11}$	$\frac{11}{12}$
b.	$\frac{1}{4}$	$\frac{3}{8}$	$\frac{4}{7}$	$\frac{4}{5}$	$\frac{5}{6}$	$\frac{5}{12}$	$\frac{3}{4}$	$\frac{3}{5}$	$\frac{1}{2}$	$\frac{6}{10}$
c.	$1\frac{1}{8}$	$3\frac{1}{3}$	$4\frac{1}{2}$	$2\frac{1}{3}$	$3\frac{2}{3}$	$5\frac{1}{3}$	$2\frac{1}{6}$	$1\frac{2}{3}$	$8\frac{1}{4}$	$1\frac{6}{15}$

Exercises on the Table.

ADDITION.

In lines *a.*, *b. c.*, add

134. i. and ii.	137. iv. and v.	140. vii. and viii.
135. ii. and iii.	138. v. and vi.	141. viii. and ix.
136. iii. and iv.	139. vi. and vii.	142. ix. and x.

Explanation. In exercise 134 the pupil will add $\frac{2}{3}$ and $\frac{3}{4}$; $\frac{1}{4}$ and $\frac{3}{8}$; $1\frac{1}{8}$ and $3\frac{1}{3}$. In exercise 135 he will add $\frac{3}{4}$ and $\frac{4}{5}$, and so on.

In columns i., ii., iii., etc., add

143. *a* and *b.*	144. *b* and *c.*	145. *a.*, *b.*, and *c.*

SUBTRACTION.

In columns i., ii., iii., etc., take

146. *b.* from *a.*	148. *c* from 10.	150. *a* + *b* from *c.*
147. *b.* from c.	149. *a* from $1\frac{1}{2}$.	

MULTIPLICATION.

In lines *a.*, *b.*, *c.*, multiply together

151. i. and ii.	154. iv. and v.	157. vii. and viii.
152. ii. and iii.	155. v. and vi.	158. viii. and ix.
153. iii. and iv	156. vi. and vii.	159. ix. and x.

Explanation. In exercise 151 the pupil will multiply $\frac{2}{3}$ and $\frac{3}{4}$; $\frac{1}{4}$ and $\frac{3}{8}$; $1\frac{1}{2}$ and $3\frac{1}{3}$. In exercise 152 he will multiply $\frac{3}{4}$ and $\frac{4}{5}$, and so on.

In columns i., ii., iii., etc.,

160. Find *a.* of *b.*	163. Find $\frac{2}{3}$ of *a.*	166. Multiply *a.* by 4.
161. Find *b.* of *c.*	164. Find $\frac{3}{4}$ of *b.*	167. Multiply *b.* by 6.
162. Find *a.* of *b.* of *c.*	165. Find $\frac{4}{5}$ of *c.*	168. Multiply *c.* by 8.

Explanation. In exercise 160 the pupil will find $\frac{2}{3}$ of $\frac{1}{4}$; $\frac{3}{4}$ of $\frac{2}{3}$; $\frac{4}{5}$ of $\frac{3}{4}$, and so on.

DIVISION.

In lines *a.*, *b.*, *c.*, etc., divide

169. i. by ii.	172. iv. by v.	175. vii. by viii.
170. ii. by iii.	173. v. by vi.	176. viii. by ix.
171. iii. by iv.	174. vi. by vii.	177. ix. by x.

In columns i., ii., iii., etc.,

178. Divide *a.* by *b.*	181. Divide *a.* by 3.	184. Divide 8 by *a.*
179. Divide *b.* by *c.*	182. Divide *b.* by 4.	185. Divide 12 by *b.*
180. Divide *c.* by *a.*	183. Divide *c.* by 6.	186. Divide 11 by *c.*

In columns i., ii., iii., etc.,

|	
187. *a.* is $\frac{4}{5}$ of what ?	190. What part of *a.* is *b.* ?
188. *b.* is $\frac{7}{8}$ of what ?	191. What part of *c.* is *b.* ?
189. *c.* is $\frac{2}{3}$ of what ?	192. What part of *c.* is *a.* ?

SUGGESTIONS AND SOLUTIONS.

As stated in the preface, it is presumed that this book will, to a considerable extent, be used without the lessons having been previously studied, the questions being read and answered at sight. It will, however, be used also to train the pupil in the proper forms of arithmetical language. These he learns by explaining problems. While his explanations should be given in his own language, he will be aided by comparing his forms with good models.

Hence a few typical examples have been solved in the body of the book, and solutions of others, to be used at the discretion of the teacher, are put in the Appendix. These are designated by the number of the example solved, together with the page where the example' occurs, thus :

Page 2. 19. *Suggestion.* Let the pupil draw diagrams when the nature of the problem admits, thus, in this problem :
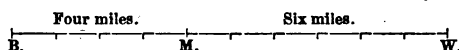
Page 4. 1. *Solution.* Since there are two pages on one leaf, on three leaves there are three times two pages, which is six pages.

Ans. Six pages.

Page 4. 5. *Solution.* He has as many sisters as there are times three plums in six plums, which is two times. *Ans.* Two sisters.

Page 14. 1. *Solution.* If 2 boys share 4 pears, each boy has 1 half of 4 pears, which is 2 pears. *Ans.* 2 pears.

Page 14. 16. *Solution.* One third of 6 apples is 2 apples, and 2 thirds is 2 times 2 apples, which is 4 apples. *Ans.* 4 apples.

Page 19. Art. 14. *Suggestion.* Use counters to illustrate to the young pupils the relations of numbers involved in this article.

Page 20. 1. *Solution.* If 1 half of the money is 2 cents, 2 halves, or the whole of the money, is 2 times 2 cents, which is 4 cents.

Ans. 4 cents.

NOTE. Similar analysis applies to the abstract question.

Page 20. 6. *Solution.* If two times the number of doves Oscar had is 4 doves, once the number is 1 half of 4 doves, which is 2 doves.
<div align="right">*Ans.* 2 doves.</div>

<div align="center">NOTE. Similar analysis applies to the abstract question.</div>

Page 21. 16. *Solution.* If 2 thirds of some number is 6, 1 third of the number is 1 half of 6, which is 3, and 3 thirds, or the whole number, is 3 times 3, which is 9.   *Ans.* 9.

Page 24. 1. *Solution.* Since 2 pairs cost 12 dollars, 1 pair costs 1 half of 12 dollars, which is 6 dollars, and 3 pairs will cost 3 times 6 dollars, which is 18 dollars.   *Ans.* 18 dollars.

Page 24. 10. *Solution.* Nine cans of 2 pints each will hold 9 times 2 pints, which is 18 pints. To hold 18 pints, it will take as many cans of 3 pints each as there are times 3 pints in 18 pints, which is 6.   *Ans.* 6 cans.

Page 30. Art. 22. *Suggestion.* The exercise by the pupils in making examples should be continued through the book, without further directions.

Page 62. 1. *Solution.* If 3 boxes cost 30 cents, 1 box will cost 1 third of 30 cents, which is 10 cents, and 2 boxes will cost 2 times 10 cents, which is 20 cents.   *Ans.* 20 cents.

Page 63. 28. *Solution.* If 1 half of the number of figs was 8, two halves, or the whole number, was 2 times 8, which is 16.   *Ans.* 16.

Page 64. 40. *Solution.* If 2 thirds of the number of cents was 24, 1 third was 1 half of 24, which is 12, and 3 thirds, or the whole number, was 3 times 12, which is 36.   *Ans.* 36 cents.

Page 73. 10. *Solution.* Since in 1 there are $\frac{4}{4}$, in 3 there are 3 times $\frac{4}{4}$, or $\frac{12}{4}$, which with $\frac{1}{4}$ added is $\frac{13}{4}$.   *Ans.* $\frac{13}{4}$.

Page 74. 22. *Solution.* Since $\frac{3}{3}$ equal a whole one, there will be as many whole ones in $\frac{8}{3}$ as there are times $\frac{3}{3}$ in $\frac{8}{3}$, which is 2, and $\frac{1}{3}$ remains.   *Ans.* $2\frac{1}{3}$.

<div align="center">NOTE. The teacher should lead the pupil to observe that in changing a fractional number to a mixed number, *the numerator is divided by the denominator,* the quotient being the whole number and the remainder the fraction.</div>

Page 76. 48. *Solution.* Since 1 equals $\frac{4}{4}$, $\frac{1}{2}$ will equal $\frac{1}{2}$ of $\frac{4}{4}$, which is $\frac{2}{4}$.   *Ans.* $\frac{2}{4}$.

Page 85. 58. *Second Solution.* $\frac{1}{4}$ of 5 is $1\frac{1}{4}$, and $\frac{2}{4}$ of 5 is 2 times $1\frac{1}{4}$; 2 times 1 are 2, and 2 times $\frac{1}{4}$ are $\frac{2}{4}$, or $1\frac{1}{4}$, which added to 2 equals $3\frac{1}{4}$. *Ans.* $3\frac{1}{4}$.

NOTE. This form of solution is preferable where the numbers are so large as to make the solution given in the body of the book difficult to perform mentally.

Page 87. 116. *Second Solution.* $\frac{1}{3}$ equals $\frac{2}{6}$; $\frac{1}{2}$ of $\frac{1}{3}$ equals $\frac{1}{2}$ of $\frac{2}{6}$, which is $\frac{1}{6}$. *Ans.* $\frac{1}{6}$.

NOTE. That $\frac{1}{3}$ equals $\frac{2}{6}$ is a fact that has been learned by observation. [See page 75.]

Page 88. 129. *Second Solution.* $\frac{1}{4}$ equals $\frac{5}{20}$; $\frac{1}{5}$ of $\frac{1}{4}$ equals $\frac{1}{5}$ of $\frac{5}{20}$, which is $\frac{1}{20}$, and $\frac{3}{5}$ of $\frac{1}{4}$ equals 3 times $\frac{1}{20}$, which is $\frac{3}{20}$. *Ans.* $\frac{3}{20}$.

NOTE. From this solution, or from that given in the body of the book, may be derived the common rule : *To multiply a fraction by a fraction, multiply the numerators together for a new numerator, and the denominators together for a new denominator.*

Page 90. 1. *Second Solution.* Since 4 is 4 ones, it contains one 4 times; it contains $\frac{1}{3}$, 3 times 4, or 12 times, and $\frac{2}{3}$, $\frac{1}{2}$ of 12, which is 6 times. *Ans.* 6 times.

NOTE. From this solution is derived the familiar rule : *To divide by a fraction, invert the divisor and proceed as in multiplication.*

Page 91. 19. *Second Solution.* Since $\frac{3}{4}$ is $\frac{3}{4}$ of 1, it contains one $\frac{3}{4}$ of a time ; it contains $\frac{1}{4}$, 3 times $\frac{3}{4}$, or $\frac{9}{4}$ times, and $\frac{2}{3}$, $\frac{1}{3}$ of $\frac{9}{4}$, which is $\frac{6}{4}$ times, equal to $1\frac{1}{2}$ times. *Ans.* $1\frac{1}{2}$ times.

Page 93. 9. *Second Solution.* 1 is $\frac{1}{2}$ part of 2 ; $\frac{1}{3}$ of 1 is $\frac{1}{3}$ of $\frac{1}{2}$, or $\frac{1}{6}$ part, and $\frac{2}{3}$ is the $\frac{2}{6}$ part. *Ans.* $\frac{2}{6}$.

Page 94. 19. First solution similar to the solution for example 9. *Second Solution.* $\frac{1}{4}$ is $\frac{1}{3}$ part of $\frac{3}{4}$; $\frac{4}{4}$, or 1, is 4 times as great a part, or $\frac{4}{3}$ of $\frac{3}{4}$; and $\frac{2}{3}$ of 1 is $\frac{2}{3}$ as great a part as 1 is ; $\frac{2}{3}$ of $\frac{4}{3}$ is $\frac{8}{9}$. *Ans.* $\frac{8}{9}$.

NOTE. In the above analysis, we first find the part $\frac{1}{4}$ is of $\frac{3}{4}$, second, the part 1 is of $\frac{3}{4}$, and finally the part $\frac{2}{3}$ is of $\frac{3}{4}$.

Page 128. 83. *Solution.* 10 % equals $\frac{1}{10}$; if $\frac{1}{10}$ of a number is 46, $\frac{10}{10}$, or the whole number, is 10 times 46, which is 460. *Ans.* 460.

Weights and Measures.

United States Money.

10 mills	= 1 cent.
10 cents	= 1 dime.
10 dimes or 100 cents	} = 1 dollar.
10 dollars	= 1 eagle.

Liquid Measure.

4 gills	= 1 pint.
2 pints	= 1 quart.
4 quarts	= 1 gallon.

Dry Measure.

2 pints	= 1 quart.
8 quarts	= 1 peck.
4 pecks	= 1 bushel.

Avoirdupois Weight.

16 ounces	= 1 pound.
2000 pounds	= 1 ton.

Also sometimes used.

28 pounds	= 1 quarter.
4 quarters	= 1 hundredweight.
20 hundredweight	= 1 ton (called long ton).

Troy Weight.

24 grains	= 1 pennyweight.
20 pennyweights	= 1 ounce.
12 ounces	= 1 pound.

As used in mixing medicine.

20 grains	= 1 scruple (℈).
3 scruples	= 1 dram (ℨ).
8 drams	= 1 ounce (℥).
12 ounces	= 1 pound.

Long Measure.

12 inches	= 1 foot.
3 feet	= 1 yard.
5½ yards or 16½ feet	= 1 rod.
320 rods or 5280 feet	= 1 mile.

Square Measure.

144 square inches	= 1 square foot.
9 square feet	= 1 square yard.
30¼ square yards or 272¼ square feet	} = 1 square rod.
160 square rods	= 1 acre.
640 acres	= 1 square mile.

Cubic Measure.

1728 cubic inches	= 1 cubic foot.
27 cubic feet	= 1 cubic yard.
128 cubic feet	= 1 cord.

Time.

60 seconds	= 1 minute.
60 minutes	= 1 hour.
24 hours	= 1 day.
7 days	= 1 week.
52 weeks 1 day or 365 days	} = 1 common year.
366 days	= 1 leap-year.
100 years	= 1 century.

Circular or Angular Measure.

60 seconds	= 1 minute.
60 minutes	= 1 degree.
360 degrees	= 1 circumference.

Surveyors' Long Measure.

7.92 inches	= 1 link.
100 links	= 1 chain (= 4 rods).
80 chains	= 1 mile.

Surveyors' Square Measure.

10000 square links	= 1 square chain.
10 square chains	= 1 acre.
640 acres	= 1 square mile or sec- [tion.
36 sections	= 1 township.

Numbers.

12 units	= 1 dozen.
12 dozen	= 1 gross.
12 gross	= 1 great gross.
20 units	= 1 score.

APPENDIX.

Multiplication Table.

1	**1**	is	1	**2**	is	2	**3**	is	3	**4**	is	4
2	1's	are	2	2's	are	4	3's	are	6	4's	are	8
3	1's	"	3	2's	"	6	3's	"	9	4's	"	12
4	1's	"	4	2's	"	8	3's	"	12	4's	"	16
5	1's	"	5	2's	"	10	3's	"	15	4's	"	20
6	1's	"	6	2's	"	12	3's	"	18	4's	"	24
7	1's	"	7	2's	"	14	3's	"	21	4's	"	28
8	1's	"	8	2's	"	16	3's	"	24	4's	"	32
9	1's	"	9	2's	"	18	3's	"	27	4's	"	36
10	1's	"	10	2's	"	20	3's	"	30	4's	"	40
11	1's	"	11	2's	"	22	3's	"	33	4's	"	44
12	1's	"	12	2's	"	24	3's	"	36	4's	"	48

1	**5**	is	5	**6**	is	6	**7**	is	7	**8**	is	8
2	5's	are	10	6's	are	12	7's	are	14	8's	are	16
3	5's	"	15	6's	"	18	7's	"	21	8's	"	24
4	5's	"	20	6's	"	24	7's	"	28	8's	"	32
5	5's	"	25	6's	"	30	7's	"	35	8's	"	40
6	5's	"	30	6's	"	36	7's	"	42	8's	"	48
7	5's	"	35	6's	"	42	7's	"	49	8's	"	56
8	5's	"	40	6's	"	48	7's	"	56	8's	"	64
9	5's	"	45	6's	"	54	7's	"	63	8's	"	72
10	5's	"	50	6's	"	60	7's	"	70	8's	"	80
11	5's	"	55	6's	"	66	7's	"	77	8's	"	88
12	5's	"	60	6's	"	72	7's	"	84	8's	"	96

1	**9**	is	9	**10**	is	10	**11**	is	11	**12**	is	12
2	9's	are	18	10's	are	20	11's	are	22	12's	are	24
3	9's	"	27	10's	"	30	11's	"	33	12's	"	36
4	9's	"	36	10's	"	40	11's	"	44	12's	"	48
5	9's	"	45	10's	"	50	11's	"	55	12's	"	60
6	9's	"	54	10's	"	60	11's	"	66	12's	"	72
7	9's	'	63	10's	"	70	11's	"	77	12's	"	84
8	9's	"	72	10's	"	80	11's	"	88	12's	"	96
9	9's	"	81	10's	"	90	11's	"	99	12's	"	108
10	9's	"	90	10's	"	100	11's	"	110	12's	"	120
11	9's	"	99	10's	"	110	11's	"	121	12's	"	132
12	9's	"	108	10's	"	120	11's	"	132	12's	"	144